August 20, 1956 50 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

Engineer Analyzes Russian Training

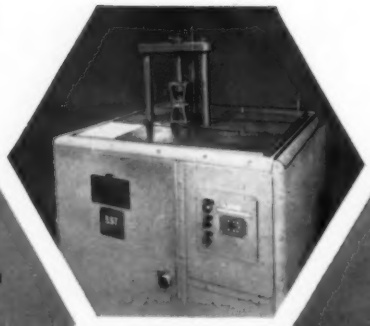
•

Monopulse Radar Aims B-52 Turret

McDonnell XV-1 Convertiplanes

imagineering

ADVANCED TESTING MACHINES



Special automatic equipment for conducting self-locking torque tests records the torque readings on a continuous tape for positive proof of locking ability.

Fatigue testing equipment for conducting accelerated service tests and evaluating the effects of dynamic loading. Typical of latest testing devices used by Kaynar Company.

SPECIALIZED KAYNAR EQUIPMENT

Kaynar engineers are aircraft engineers designing aircraft nuts for the aircraft industry. They are close to the field; can solve your fastening problems first hand.

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Imagination plus engineering know-how is teamed at the Kaynar Company. Imagineering pioneered the unique, full-strength, self-locking design of the Kaylock nut that is now the most copied nut in the world. Imagineering created the first lightweight low height steel anchor nut, the first narrow lightweight gang channel, the first lightweight floating anchor nut, the first miniature fixed and floating anchor nuts, the first floating counter-bore nut, and the first light weight and low height hex nut for both internal and external wrenching.

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RARELY do you find a precious commodity that can be numbered in the thousands.

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Their prime objective has long been to "Keep America First In The Air," and foresighted management has provided engineering facilities and leadership that have more than matched the challenge.

The facilities in Akron and Arizona represent huge investments made in anticipation of the important roles they were destined to play. They have made possible the design, testing and production of a host of vital contributions *at a juncture in this nation's future where time is of the essence.*

The fruits of these facilities—concepts of Goodyear aircrafters which have been engineered, developed and produced—make interesting reading in the light of present-day aeronautical needs:

A case in point is ATRAN, the brilliant all-weather aircraft navigational equipment born of Goodyear skills. Another is the new GEDA A-14 analog computer. Beyond that, Escape Capsules, Thrust Reversers, Radomes without "cross-talk" and Inflatable Airplanes that can be rolled up like a rug.

Ground Handling Systems for Missiles, Stretched Canopies, and 1-Man Helicopters—

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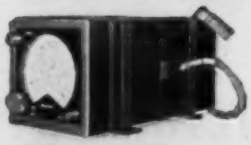
ANT-1 Antenna

RDR-1 Transmitter-Receiver



PPI-1 Indicator

CON-1 Control Unit

New . . . Lighter, Smaller Synchronizer For BENDIX Weather Radar System

This new SYN-1B Synchronizer—heart of the Bendix* RDR-1 Weather Radar System—represents the ultimate in lightweight design for this type of equipment. It weighs only 21 pounds—27 pounds less than its larger predecessor. The number of vacuum tubes used has been reduced from 32 to 19.

The SYN-1B Synchronizer is but one of several advancements incorporated in the Bendix RDR-1 Weather Radar System. Four types of antennas are available. Improved contour circuitry in the Transmitter-Receiver unit assures even greater trouble-free operation. All relays are protected against dust particles by easily accessible, removable covers.

Get the full story on Bendix Weather Radar. Find out why it is fast becoming the leader in its field. Contact your local Bendix Aviation Radio Representative. Or write the factory direct. Address below.

* Reg. U. S. Pat. Off.

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West Coast Sales: 10500 Magnolia Blvd., North Hollywood, California
Export Sales and Service: Bendix International Division, 205 E. 42nd St., N. Y. 17, N. Y., U.S.A.
Canadian Distributor: Aviation Electric, 200 Laurentian Boulevard, Montreal, Quebec

Bendix AVIATION Radio

Bendix AVIATION CORPORATION

AVIATION CALENDAR

Aug. 22-24—Bendix Aviation Corp.'s 1956 International Ignition Conference, Sidney, New York.

Aug. 27-29—Association for Computing Machinery, annual meeting, Univ. of Calif. Westwood Campus, Los Angeles.

Sept. 1-3—1956 National Aircraft Show, Will Rogers Field, Oklahoma City.

Sept. 3-7—Canadian National Air Show, Toronto, Canada.

Sept. 3-9—Society of British Aircraft Constructors' 17th Annual Air Show, Royal Aircraft Establishment, Farnborough, Hampshire, England.

Sept. 6—Seventh annual Engine Operation & Maintenance Forum, sponsored by Airwork Corp., Pratt & Whitney Aircraft, at Airwork Corp. and Millville Airport, Millville, N. J.

Sept. 8—First annual National Convention of the OX5 Club, Williamsport, Pa. Contact: Clifford Ball, Secy., OX5 Club, 214 Plaza Bldg., Pittsburgh, Pa.

Sept. 9-11—International Northwest Aviation Council, 20th annual convention, Boise, Idaho.

Sept. 10—Pratt & Whitney, Southwest Airmotive Co. Engine Forum, Melrose Hotel, Dallas.

Sept. 10-14—American Society of Mechanical Engineers, Instruments & Regulators Div. Meeting, Detroit, Mich.

Sept. 17-21—American Society for Testing Materials, Second Pacific National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles.

Sept. 17—International Air Transport Association, 12th annual general meeting, Edinburgh, Scotland.

Sept. 17-21—Eleventh Annual Instrument-Automation Conference & Exhibit, sponsored by the Instrument Society of America, Coliseum, New York, N. Y.

Sept. 17-22—International Congress of Astronautics, sponsored by the International Astronautic Federation, Rome, Italy.

Sept. 18-20—Twenty-fourth USAF-Aircraft Industry Flying Safety Conference, sponsored by USAF Flight Safety Research, Santa Barbara, Calif.

Sept. 24-26—American Rocket Society, fall meeting, Hotel Statler, Buffalo, N. Y.

Sept. 24-28—1956 Trade Fair of the Atomic Industry, Navy Pier, Chicago.

AVIATION WEEK • AUGUST 20, 1956
Vol. 65, No. 8

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph T. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

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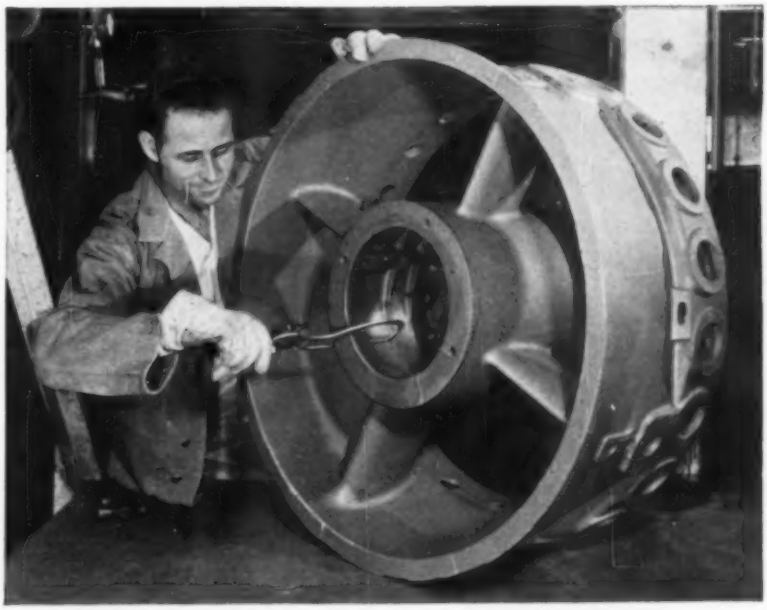
QUALITY MAGNESIUM CASTINGS



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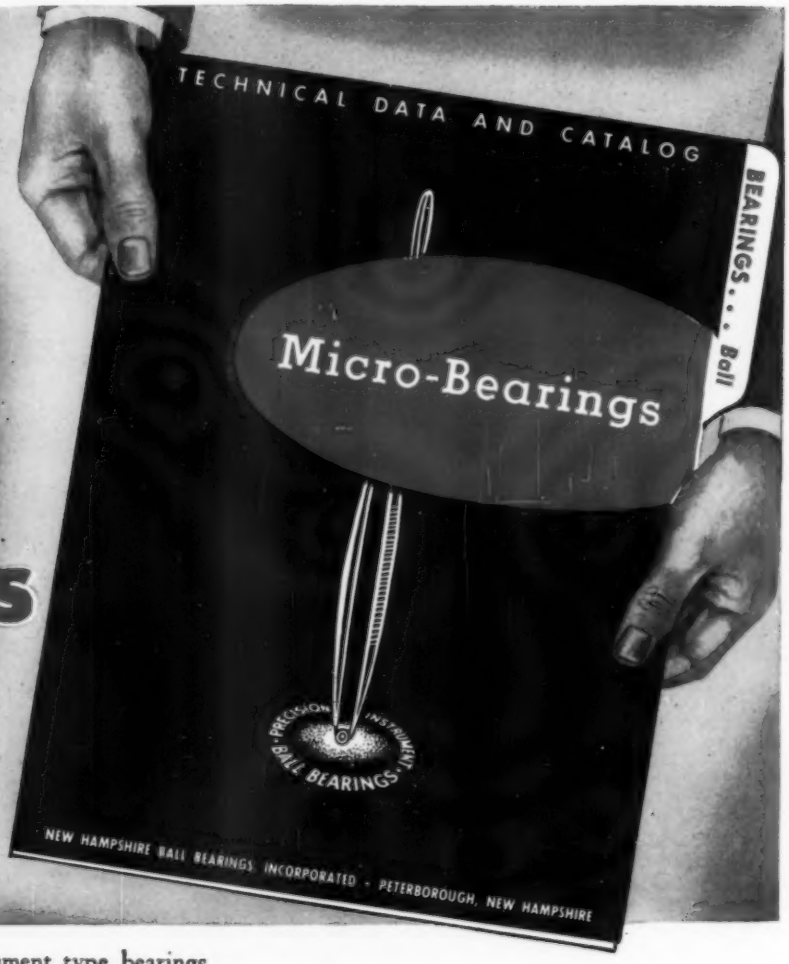
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If you work with small instrument type bearings you'll find this new, authoritative publication an extremely valuable and handy source of engineering data arranged in convenient form for practical reference.

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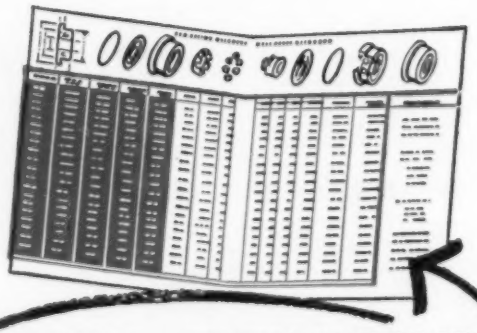

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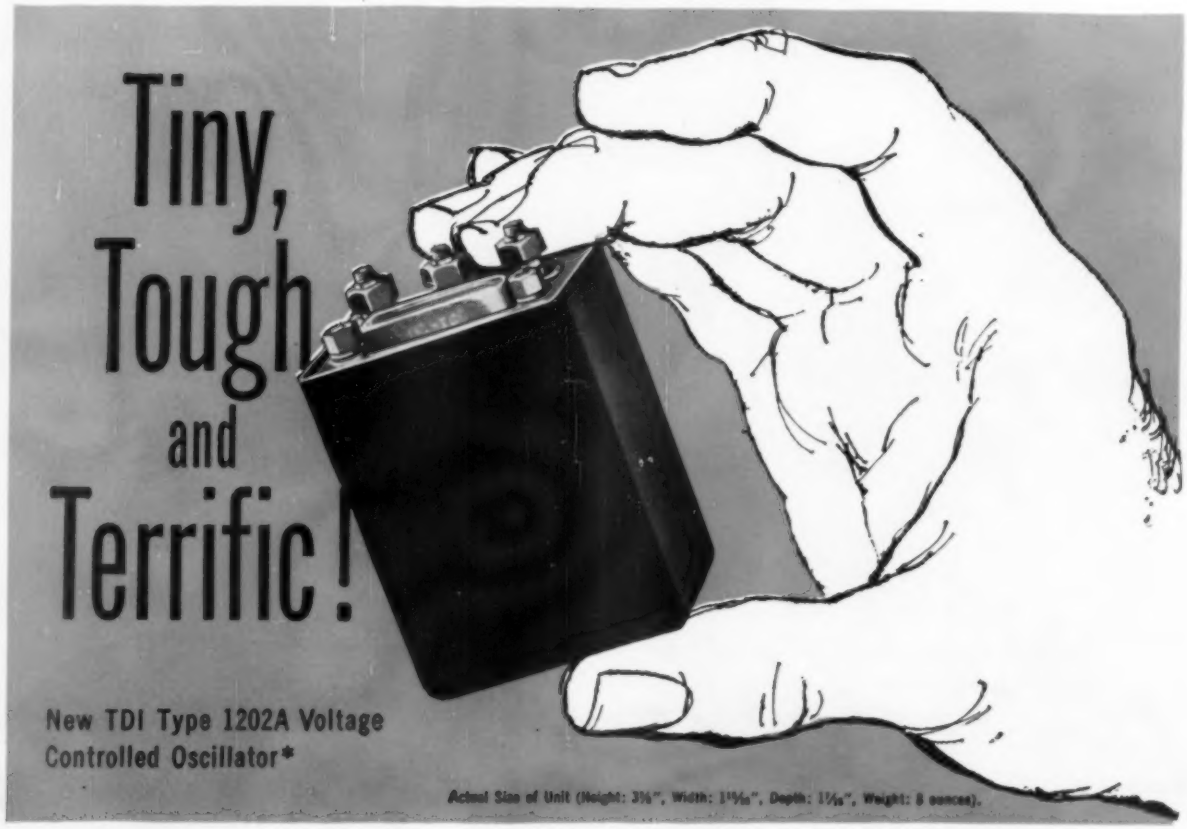

This new TDI voltage-sensing subcarrier oscillator weighs in at only 8 oz.—is approximately one-half the size of previous oscillators—contains only two tubes, compared to present day five-tube circuits—but these are no indication of its outstanding performance! Reliability under typical (and that means extreme) environmental conditions is nothing short of amazing.

Interested? You can learn more by sending today for free technical data and detailed specifications of TDI's newest precision component for in-flight telemetering. Bulletins of other TDI remote instrumentation products sent on request.

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TEMPERATURE—Designed for operation from −65° C to +100° C

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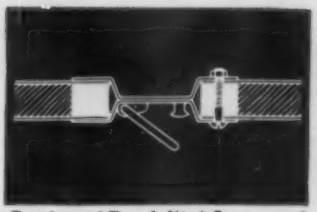
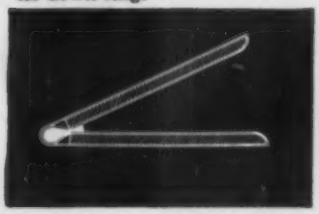
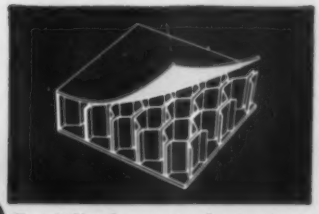


Section of Bondolite® floor panel (®T. M. Goodyear Aircraft Corporation) with inserted cargo tie-down ring.



Wing flap section made from Bondolite. Bend is reinforced with Epon Adhesive VI.



Bondolite honeycomb construction. Epon Adhesive VI bonds aluminum skin to central aluminum honeycomb.

EPON® ADHESIVES?

New Epon adhesives are being specified to replace expensive riveting and welding in an ever-increasing variety of aircraft applications. Because they contain no solvents, Epon adhesives permit immediate assembly of metal-to-metal bonded parts. Contact pressure alone is all that is required to form sound bonds. Surfaces before bonding need not be machine-finished and glue lines need not be uniform. Air-relief drilling is never needed.

For your specific needs, three standard formulations are:

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Epon adhesives have been used successfully in bonding metal, plastics, rubber and wood for helicopter rotor blades, honeycomb wing sections, jet fuel tanks, radar antennae, structural joints and floor panels. Can Epon adhesives solve an assembly problem for you? Write us about your problem and we'll send full technical information and samples.

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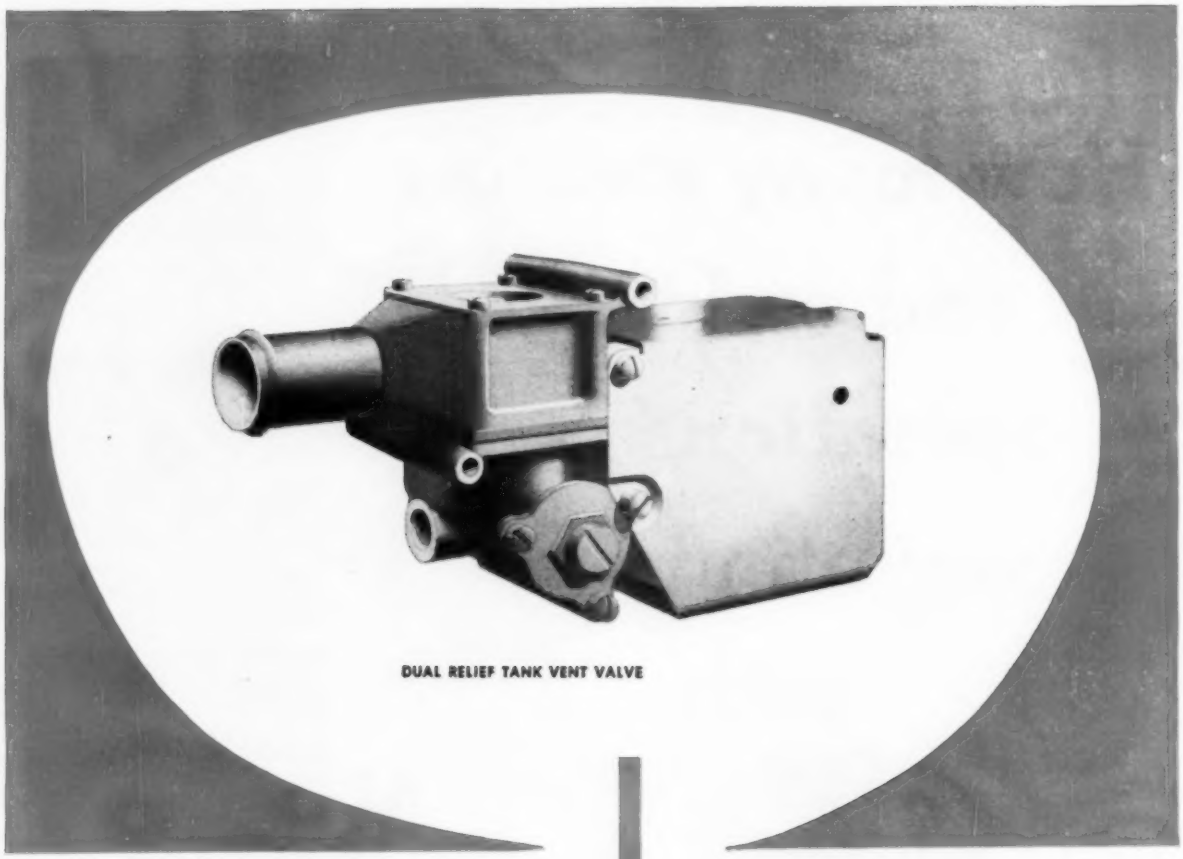

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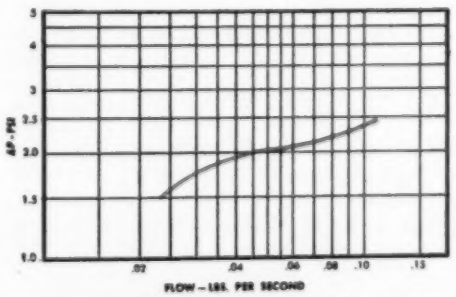

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Above photo shows spray pattern as model hull slices through the water. Data recording devices travel with the model over stainless steel rails. High-speed motion picture cameras record hull performance through heavy plate glass windows in sides and bottom of tank.

New use for Stainless Steel developed by Convair in testing seaplane hull models

Stainless steel bars are playing an important part in testing hulls for advanced-type seaplanes at Convair's new 300-foot model seaplane towing tank, first unit of a proposed $800,000 hydrodynamic laboratory. Convair is a Division of General Dynamics Corporation.

Testing is conducted by suspending a hull model from a carriage which runs on a double overhead rail. The rails are 1¾"-dia. cold finished stainless steel bars. Carriage rollers which run on the bars are also stainless steel. The rails are suspended three feet over the water level on "I" beams and tubular steel framework towers.

Stainless steel was selected for this application because of its extremely high resistance to corrosion, wear and abrasion—resulting in ease of maintenance. Cold finishing the bars provides the additional benefits of higher tensile and yield strength, close tolerance, uniform soundness and a fine surface finish permitting smooth, accurate operation of the testing device.

Stainless steel is the aircraft metal of many uses. It has literally thousands of both ground and air applications. Its exceptionally high

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Seaplane hull model is poised for run down 300-foot long towing tank. When complete, entire facility will be 700 feet in length and will be enclosed in a windproof structure to prevent gusts and inclement weather from interfering with tests.

strength-to-weight ratio permits the use of thinner, lighter sections. Use it to gain space or save weight without any sacrifice in strength or safety. Or use it to resist heat, corrosion and abrasion.

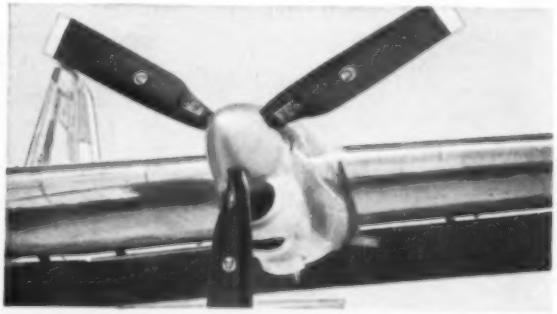
Republic—world's largest producer of aircraft steels—supplies ENDURO Stainless Steel in all commercial forms including hot rolled and cold finished bars, forging stock, plates, sheets, strip and wire. Republic metallurgists and engineers are ready to help you apply stainless steel to your present and future development work. There's no obligation. Just mail the coupon.

STEEL

and Steel Products

ANOTHER NEW USE FOR STAINLESS STEEL was created with the advent of the turboprop engine. Tank trucks used in refueling turboprops consist of two separate compartments. One is fabricated from Republic ENDURO Stainless Steel to resist the corrosive effect of the alcohol-water mixture. The other, for kerosene, is made from Republic 50 High Strength Steel for lightness and strength. The compartments are then welded together into one strong unit.

NEWCOMER AMONG AIRCRAFT METALS—TITANIUM saves weight and cuts cost in Navy helicopter. Use of .016 gage Republic Titanium, Type RS-70, Annealed, for firewall sections between pilot and engine compartments has resulted in substantial savings in weight and production costs. This type has good forming qualities and a minimum tensile strength of 80,000 psi. Republic melts and rolls titanium in all forms.



NEW EXTRUSION PROCESS AND ALLOY STEEL combine to provide greater strength and resistance to fatigue with minimum weight in turboprop propeller blades. The extruded blade, produced by the controlled extrusion process developed by Curtiss-Wright, starts as a single-piece billet of Republic Alloy Steel. The outstanding qualities of Republic Alloy Steel together with the extrusion process have resulted in a superior blade and increased production with reduced cost.

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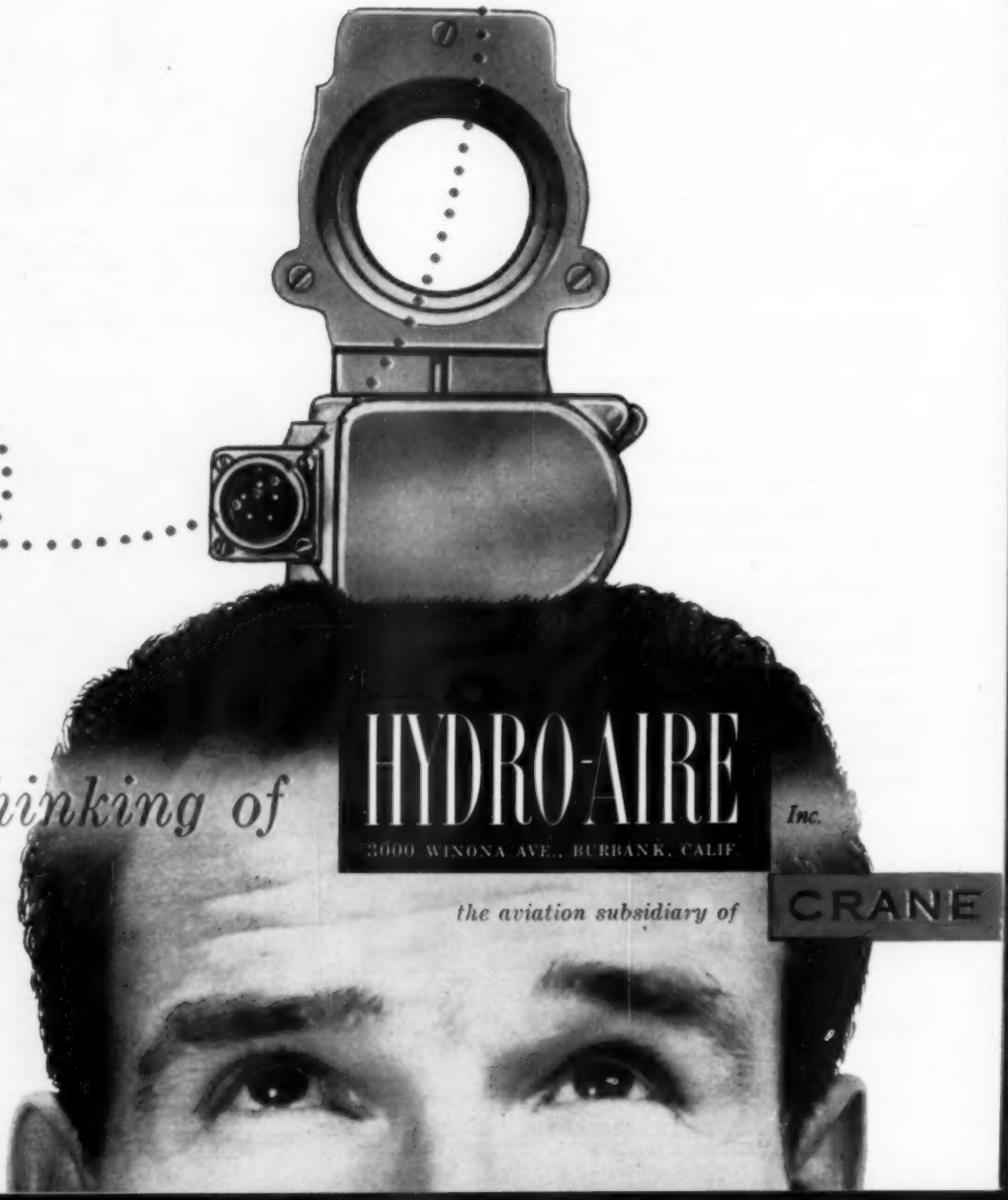

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3000 psi . . . CONSTANT DISPLACEMENT

These new miniaturized hydraulic pumps were developed by Vickers for limited life applications such as missile and ram air turbine driven hydraulic systems . . . also for motorpump assemblies supplying emergency power on aircraft.

A distinctive feature is adaptability to manifolding and special mounting. This permits integration with the balance of a "packaged" hydraulic system to provide hydraulic power in the most compact and lightweight form yet devised. Some sizes are capable of delivering more than five horsepower per pound of weight.

Available in four size series, this miniaturized pump has the same basic characteristics as the standard Vickers piston type pump which has been establishing outstanding performance records on aircraft since 1940. Ask nearest Vickers Aircraft Application Engineer for further information.

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This Hydraulic Pump has 4.3 hp output @ 3000 psi and 12,000 rpm. Weight 0.9 lb.

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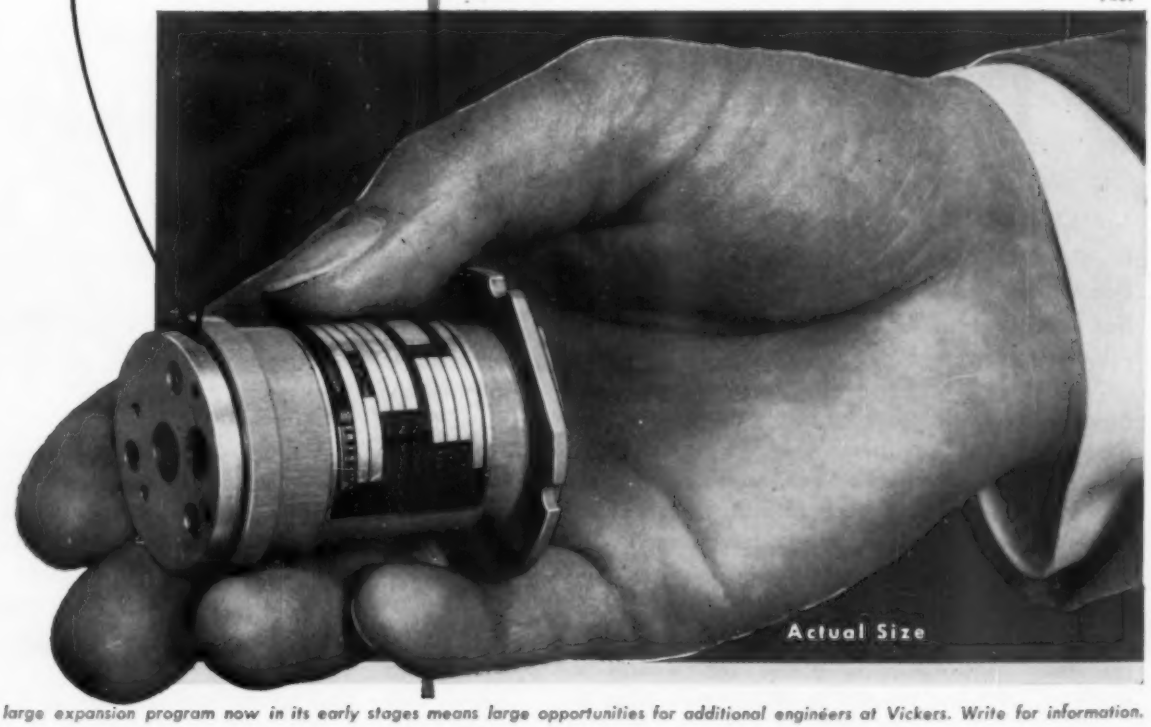

A large expansion program now in its early stages means large opportunities for additional engineers at Vickers. Write for information.

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E. Merritt (Andy) Anderson, Shell Aviation Dealer at General Mitchell Field, Milwaukee, has a knack for making friends and making money. Maybe that's because he keeps so busy.

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AUGUST 20, 1956

AVIATION WEEK

VOL. 65 NO.8

Editorial Offices

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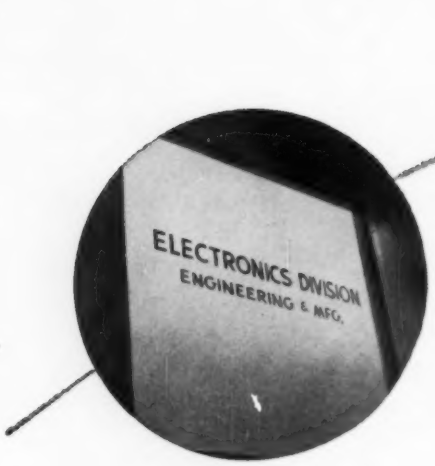
COVER: McDonnell XV-1 Convertiplane, which has reached 200 mph. to exceed unofficially speed record for helicopters (AW Aug. 13, p. 33), has made 39 flights in which five conversions were accomplished from helicopter rotor takeoff to airplane forward flight and back to rotor for landing. Flown by Capt. Wayne W. Eggert, Air Research and Development Command test pilot, the craft was operated as helicopter, autogiro and airplane. Two XV-1s have been built and are flying. Pressure jet engines at the rotor tips provide power for helicopter flight. When flying speed is attained, power may be shifted from rotor to pusher propeller, with the rotor allowed to windmill. Flight controls are shifted simultaneously from rotor to conventional type.

Picture Credits:
39—Wide World; 64—Warren D. Shipp.

66,773 copies of this issue printed

AVIATION WEEK • AUGUST 20, 1956 • Vol. 65, No. 8
Member ABP and ABC



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EDITORIAL

More Information Please

The airlines are well along on the biggest year in their history. Domestic traffic is booming despite some bad summer weather breaks and transatlantic travel will set new records in 1956. This heavy traffic is placing a new, unprecedented customer handling load on airline personnel at the grass roots level where reservations, ticket counter and flight personnel meet the passenger face-to-face.

It is contact at this level that should draw more attention from airline management. For while the rising traffic curve charts look fine on executive office walls, they will not continue to rise unless the passengers who buy the tickets are satisfied with airline service. There is no doubt about the fact that airlines today offer the best buy in the travel business and in some segments of the industry there is a genuine effort to provide the passenger with effective service and make every effort to retain his good will and future business.

Gripe From Public

However, there is one gripe with airline service from the traveling public that we hear in rising volume in the crowded passenger waiting rooms of the airports around the country. The complaint involves the deteriorating rate of published schedule reliability and the lack of information provided by the airlines to the passenger when major traffic delays occur.

The flying public is sufficiently sophisticated by now to know that weather and traffic control delays are inevitable and necessary to maintain safety. They also know that mechanical problems are a frequent cause of delays and show no reluctance to wait for an aircraft that needs some fixing.

What does irk them to the point of profanity is the lack of information on these delays provided by the offending airline. Depending on the length of the delay, the passenger needs to make many personal adjustments to the problem. Without honest, prompt information on the nature and length of delay he is doomed to frustration and fiddling away considerable time milling around ticket counters and loading ramps.

Two recent personal occurences illustrate the problem. Returning from Milwaukee to Washington, we checked the airline before departing for the magnificent new terminal building at Billy Mitchell Field and were assured our flight was on time.

Arriving at the airline check-in counter fifteen minutes later, we were told there would be "a slight delay." This performance was repeated at intervals for five solid hours until the airline finally admitted that the flight was still on the ground at its point of origin in St. Paul. The flight finally left Milwaukee six and a half hours late. In the meantime twenty passengers, some of them with children, had been kept milling aimlessly around the airport.

Real Delay: 70 Minutes

A few weeks later when the same type of delay developed on a New York-Washington flight we checked the airline's flight operations and were told promptly and courteously that the flight was mechanically delayed in Albany and would be 70 minutes late. At the same time the cash customers crowding the ramp were being deluded with "15 minute delay" signs chalked on a board at regular intervals.

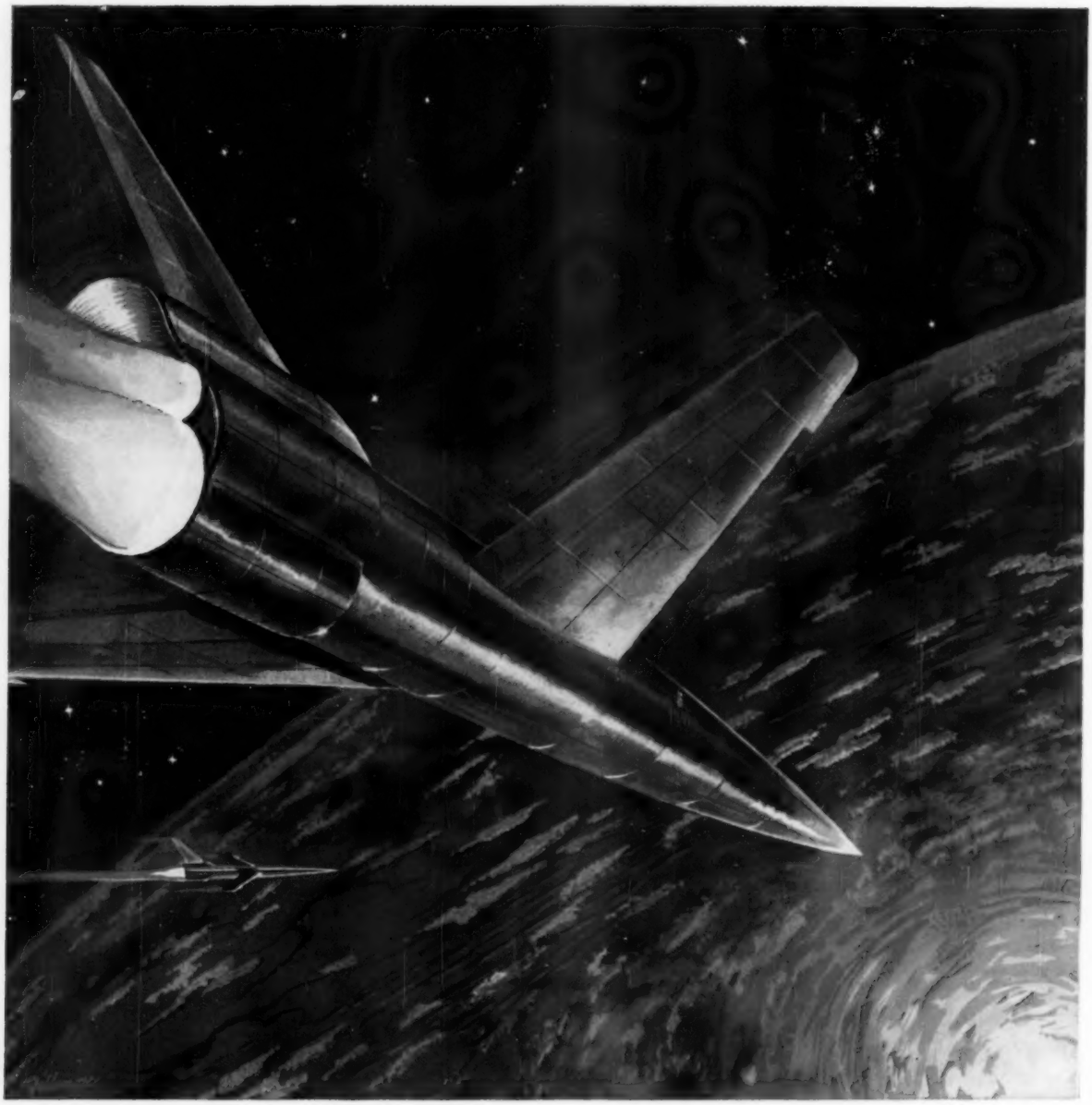
Washington Post columnist Bill Gold found an ingenious method of extracting information from another reluctant airline on a flight to Florida. He called the city editor of a local paper and told him the airline had a flight 90 minutes overdue on a scheduled 60-minute flight. Then he watched the ticket counter phone ring and a hastily scribbled "flight still on the ground in Jacksonville" appear on the blackboard amid cheers of passengers who had been waiting an hour and a half for this information.

Sure it will take some time and cost some money to provide better flight information for passengers. Any improvement in passenger service will. But in the rush of the tremendous volume of air travel and unprecedented prosperity for most airlines it would be wise for airline personnel from the presidents down to counter agents to remember they are still dealing with people and to avoid treating them like a commodity.

As Bill Gold put it so well:

"Give it to us straight, gentlemen of the airlines. We passengers are the best friends you ever had."

—Robert Hotz



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Norman Warren, vice president, Lear, Inc., Santa Monica, Calif. Also: **Joseph M. Walsh,** assistant secretary; **Forrest D. Beamer,** assistant secretary-treasurer.

Honors and Elections

Winners of the 1956 Harmon International Aviation Awards for the world's outstanding aviator, aviatrix and aeronaut are: (aviator) **Grp. Capt. John Cunningham,** chief test pilot, de Havilland Aircraft Company, Ltd., "for outstanding contributions to the development of commercial jet-propelled air transportation through piloting Britain's Comet III around the world . . ."; (aviatrix) **Mme. Jacqueline Auriol,** "for reaching a speed of 715.35 mph. in a French-built Mystere IV jet-propelled fighter on May 31, 1955, and thereby becoming the world's fastest woman pilot."; (aeronaut) **Lt. Cmdr. Charles A. Mills** (USN), "for operating his airship in an ice-accreting experiment unparalleled in airship history. . . ."

Pan American-Grace Airways has received the Inter-American Safety Council's Aviation Award and the National Safety Council's Award of Honor for its perfect safety record in 1955.

William S. Fonda, test engineer, Radioplane Co. was presented the USAF Excep-

(*Continued on page 100*)

INDUSTRY OBSERVER

► Navy is seriously considering an atomic powered submersible aircraft carrier. The underwater aircraft carrier would be able to launch 18 bombers capable of carrying atomic and thermo-nuclear weapons. Electric Boat Division of General Dynamics Corp. is interested in building a prototype.

► **Two North American B-2C rocket engines are being tested at Edwards Rocket Base, Calif., for use in a static vehicle for tests of Convair's Atlas intercontinental ballistic missile. The engines are still in the research and development stage, and characteristics and performance have not been completely determined. A single Atlas test vehicle for the captive runs costs about $1.5 million.**

► Pratt & Whitney Aircraft mapped a development program for the J75 turbojet, boosting it from its present dry rating of about 15,000 lb. to more than 18,000-lb. thrust without afterburner. Navy is extremely interested in the J75 for several of its advanced projects.

► **USAF may ease its serious refueling problem by converting a number of Boeing B-47s into tankers for "buddy system" refueling of other Stratojet medium bombers. The B-47 tankers also might be used to refuel fighters on long-range missions.**

► Component unreliability still plagues the Atlas missile program. An epidemic of test postponements broke out during the last few weeks. Causes ranged from minor bugs, such as bad O-ring seals, to major design flaws caused by the engineering magnitude of the task.

► **Hybrid rocket system incorporating both solid and liquid propellants has been developed and tested by General Electric Co. The system is self igniting, using 90% hydrogen peroxide as an oxidizer and polyethylene as fuel.**

► Hamilton Standard Division of United Aircraft will fabricate the prototype propeller assemblies for the Douglas XC-132 turboprop transport. The large transport will be powered by four Pratt & Whitney T57 turboprop engines.

► **West Germany will order 68 Hawker Sea Hawk Mk. IV navy fighters for its naval forces. Cost will exceed $14 million. Another West German order for 16 Fairey Gannet anti-submarine aircraft and spares will exceed $5 million.**

► Rocket exhaust flame heats can be lowered by using chemical additives in the propellants. Potassium nitrate proved to be best of four suppressants tested by the Aerojet-General Corp.

► **Erosion of metal vehicles in hypersonic flight in the ionosphere and outer space is being studied by General Mills. Erosion conditions are simulated by bombarding a sample metal target with a stream of ions accelerated by an electrical field.**

► Maximum letdown rate for the Bristol Britannia is limited to 500 fpm. because of the aerodynamic cleanness of the airplane and the inability to use the propellers to absorb energy during a descent. Bristol hopes to solve the problem by creating additional drag area through aerodynamic means or by strengthening the landing gear so that it can be utilized as an air brake.

► **First Canberra medium bombers to be produced by the Australian Government Aircraft Factories in Melbourne is scheduled to roll off the production line sometime next year.**

► American Bosch Arma Corp. has been awarded a $1.1 million USAF contract for the manufacture of support facilities for Convair's Atlas intercontinental ballistic missile.

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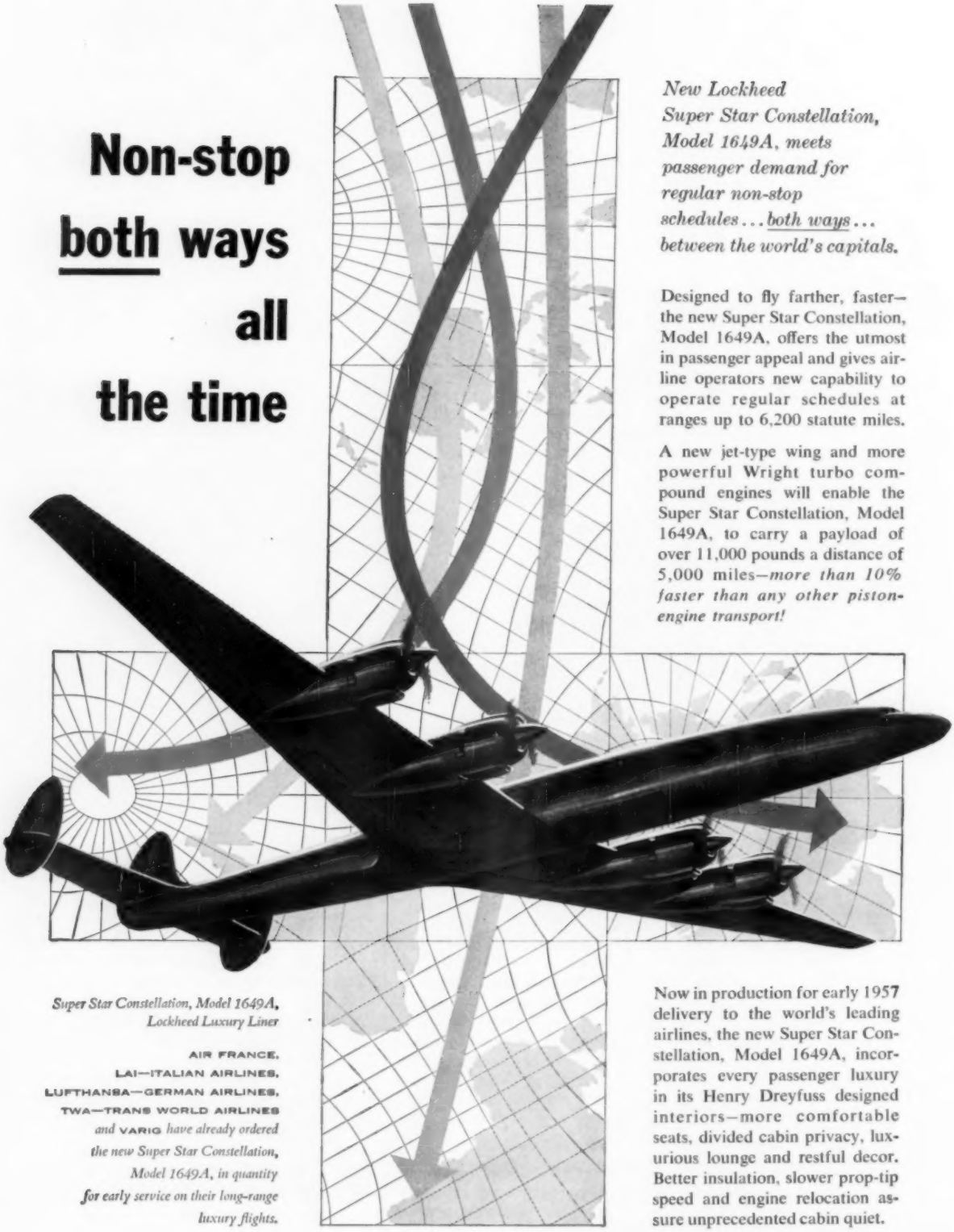

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Super Star Constellation, Model 1649A, Lockheed Luxury Liner

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WASHINGTON ROUNDUP

Wilson's Boomerang?

Defense Secretary Charles E. Wilson's determined effort to tighten what he considers a lax grip on military secrets may boomerang with recommendations for complete overhaul of his security system to eliminate delays and persistent absurdities and make application of secrecy more realistic. Charles A. Coolidge of Boston, former assistant secretary to Wilson, has been named head of a committee to review directives, regulations, practices and procedures to find better means of "safeguarding" classified information. Wilson says he wants to eliminate a "threat to the national security." Pentagon speculation is that the Coolidge committee may step outside the realm assigned and take cognizance of charges by the House Information Subcommittee that the Defense information policies are "the most restrictive and . . . most confused in the government (AW July 30, p. 30).

Coolidge committee includes four retired military officers: Admiral William M. Fechteler, USN; Gen. Gerald C. Thomas, Jr., USMC; Gen. John E. Hull, USA, and Lt. Gen. Idwal H. Edwards, USAF. Naming the group, Wilson charged that "over the past several months, classified documents, staff studies and other classified military information have been disclosed to unauthorized persons . . . this must stop." Wilson's action in the face of an impending all-out attack on his information policy by the next session of Congress is viewed in Pentagon corridors as an opportunity for the committee to suggest corrective action as well as a program that would plug major leaks attributed to inter-service rivalries.

Wilson also is known to be irked by disclosure during the Air Force Assn. convention of the 1,900 mph. mark set by the Bell X-2 rocket plane. This leak is believed to be a paramount reason for last week's shift of Brig. Gen. Robert L. Scott, Jr., from his post as USAF information chief to command of a combat training wing at Luke AFB, Ariz. Scott has been replaced by Brig. Gen. Andrew J. Kinney, former executive assistant to USAF Secretary Donald A. Quarles and a man presumably well indoctrinated in the Eisenhower Administration's views on public information.

Airspace Investigation

A House Commerce Subcommittee which began an investigation of airspace use by visiting Las Vegas, Nev., after the United-TWA accident over the Grand Canyon, will resume hearings in Washington Sept. 11. The subcommittee, headed by Rep. Oren Harris (D.-Ark.), will hear testimony from Civil Aeronautics Administration and Civil Aeronautics Board officials and will query the Air Navigation Development Board on the Tacan VOR-DME controversy unless it has been resolved by that time.

Hush-Hush on Plush

Army, usually loquacious about new ideas in the field of aircraft improvement, has been abnormally quiet about its latest project—the plushing-up of a Vertol H-21 helicopter for hauling VIP's around Washington. The H-21, competent heavy-load carrier but uncomfortable and noisy, won no praise as luxurious transportation when it was used to move top-ranking Defense Department officials out of Washington to their retreat in Operation Alert. The initial program was to install nine airline-type seats, carpets and insulation to cut down noise and vibration. Delivery of the first unit by Air Service, Inc., Trumbull, Conn., was marked by no Army fanfare, resulted in speculation that order may be changed to fewer than the eight originally planned for deluxe fittings. Helicopters in question are assigned to 509th Helicopter Company at Ft. Belvoir, Va.

Wilson on Single Service

Efforts to promote a single military service with a single chief of staff are almost certain to be opposed by the Eisenhower Administration. Defense Secretary Charles E. Wilson said last week that the idea, favored by the Air Force Assn., would not eliminate differences of opinion between Army, Navy and USAF proponents. Placing everyone in the same uniform, he told the Veterans of Foreign Wars at their Dallas encampment, would only force arguments out in "other forms" and stifle "intelligent discussions." Wilson believes the present three-service organization should get "years of trial" before it is changed. He denied to the VFW that budgetary considerations are dictating defense requirements. He also said he is frequently asked: "Is any nation ahead of us in the arms race or likely to be ahead of us in the next few years?" The Secretary replied that no nation is ahead of us now—but failed to answer the rest of his question.

Buffaloed

Sen. Leverett Saltonstall (R.-Mass.), who referred last winter to this country's "stockpile of intercontinental ballistic missiles," admits he also has trouble with aircraft identifications.

Recently released transcript of Senate Airpower Investigating Subcommittee's final session has this exchange between Saltonstall, USAF chief of staff Gen. Nathan F. Twining, and Chairman Stuart Symington (D.-Mo.):

Symington: "A statement was made Sunday on a national television program that the United States had 10 times as many B-47s as the Communists have Badgers."

Saltonstall: "Mr. Chairman, the record should show that I made that statement and it was in error. I was thinking of the Bison. Isn't that the Bison, the big one that corresponds to the B-52? What corresponds to the B-52?"

Gen. Twining: "The Bison."

Saltonstall: "Bison."

Symington: "And Bear."

Saltonstall: "I was thinking of the Bison."

New CAB Liaison Chief

Civil Aeronautics Board last week appointed William Kloepfer, Jr. as head of its Office of Congressional Liaison and Public Information. He replaces Rod Kreger who resigned in protest last May when CAB Chairman James R. Durfee reinstated Edward E. Slattery, Jr. as Chief of the Public Information Section.

Kloepfer came to the CAB from Capitol Hill where he was administrative assistant to Congressman Laurence Curtis (R.-Mass.). He is a former Texas and Washington, D. C., newsman, and from 1952 to 1955 served as assistant to the director of public relations of the Republican National Committee. —Washington Staff

CAA Activates Federal Airways Plan

First equipment orders for three-year program to be made within week; new control office created.

By L. L. Doty

Washington—Civil Aeronautics Administration's accelerated federal airways program will begin moving from the paper to the hardware stage within the next week.

With new money to help telescope the original five-year program into three, the CAA last week announced a reshuffling of departments to help push the plan. It also held final discussions with manufacturers on the type of long-range radar best suited for the program and made these immediate hardware plans:

• **Contracts for an estimated 80 VOR** units will be let next week.

• **Within two weeks, bids will be let** for approximately 1,000 transmitters costing about $1 million. The transmitters will be installed to implement high-altitude traffic control.

• **Bids for high-altitude control** receivers also will be accepted within the next two or three weeks. The program calls for control of all aircraft operating at altitudes of 15,000 ft. or above. The CAA expects that 50 such stations will be in operation by Jan. 1. Eventually, there will be 200 such units.

Fiscal 1957 appropriations by Congress provide a total of $85 million to initiate the program the CAA needs to meet the jet transport age. Of this total, $45 million was added in the closing days of the session after President Eisenhower requested funds to compress the plan into three years.

Resignation Program

This meant some reprogramming, but James Pyle, CAA deputy administrator, said last week that both he and CAA Administrator Charles Lowen are confident the three-year target can be met.

CAA's reorganization, while minor in scope, is a streamlining process designated to insure efficient implementation of the over-all program. Pyle said the chief effect of the reorganization on CAA personnel will be beneficial.

As an example of this, he pointed to the new office of Air Traffic Control headed by D. D. Thomas. This office, he said, will give controllers and control functions "a voice at policy level for the first time."

The ATC office has been established with all branch heads serving in an "acting capacity" until final details of its organization can be worked out. The department is divided into three main sections—planning, operations and procedures. Deputy director is H. S. Chandler.

Underlying philosophy behind the revised structure is to establish a direct line of responsibility between the administrator and the CAA's three programming offices. These are Air Navigation Facilities, Airports and Aviation Safety.

Under the previous arrangement, office heads reported to assistant administrators. Now, for the first time, office chiefs will report directly to Lowen and be held fully responsible for the affairs of their departments.

Pyle called the new arrangement a "straight-line organization" that will eliminate devious operating methods and halt any work-flow interruptions.

More Research Needed

Funds appropriated for the three-year plan will be spent for equipment already in being. Pyle said, however, there is a need for an increase in the "tempo of research and development on more advanced and more automatic equipment."

Among new equipment Pyle would like to see to meet jet-age problems:

• **Better radar technique.** Precipitation clutter, Pyle said, must be eliminated before radar can be fully effective at times it is needed most. To this end, CAA hopes to fit radar equipment with circular polarization circuitry that will minimize the clutter element. As soon as possible, new radar will be so equipped, and old units will be retrofitted.

• **Radar safety beacons.** Pyle wants reinforced radar signals, better return and greater range.

• **Data transfer facilities.** Improved air-to-ground communications must be implemented as soon as possible. Pyle looks for a gradual phasing out of two-way radio communications which he terms too slow, too cumbersome.

• **Distance measuring equipment.** Pyle pleaded for a prompt resolution of the Tacan/VOR-DME controversy. This is essential, he said, for the more accurate position reporting needed to cut down airspace assigned to each aircraft. The NAV panel of the Air Coordinating Committee is scheduled to report its findings on the issue today. Within 30 or 40 days, the ACC is expected to announced a decision which may settle the long-drawnout hassle.

• **Better display techniques.** Pyle termed the hand-written flight strip method as incapable of coping with present day traffic problems and wants an electronic solution to the problem.

More Money Needed?

The additional $45 million appropriated by the 84th Congress after the presidential request for $68 million may still not be enough to see the program through fiscal 1957.

Pyle said there is a possibility the CAA will request additional funds after Jan. 1. Appropriations, however, must be accompanied by accelerated procurement and staffing if the three-year goal is to be attained.

Pyle said the three-year program also will give the CAA control over a much greater range of air space. At present, he said, the CAA controls only a limited portion of airspace—about 70,000 miles of federal airways. With the addition of 71 long-range radars to the two now in operation at New York and Washington and the increase in omniranges from the currently operated 418 to a projected 800, controllers "can keep under surveillance any part of the air-space in the U. S.," he asserted.

Military Supports Program

Pyle said the CAA has gained the support of the military for its airways program, and disclosed for the first time that the USAF has offered a second Martin B-57 to help the CAA conduct high-altitude airways and navigation tests. The first medium-range bomber will begin experimental flights late this fall.

To integrate military traffic into the over-all plan, the CAA has established a Central Altitude Reservation Facility in Kansas City. Serving as a coordinator with control centers throughout the U. S., the Kansas City unit is charged with the allocation of all space for military flights.

Requests for altitude reservations are referred to the control center by CAA branches.

Controller Problems

Pyle also paid tribute to the 8,000 persons operating the airways system

Taylor Leaves ANDB

Washington—Colonel J. Francis Taylor, Jr., former director of the Air Navigation Development Board, last week joined the 1800th AACS Wing Headquarters at Tinker AFB. As yet no successor to Taylor has been named. Deputy Director D. K. Martin, former Bell Telephone Laboratories official, is serving as acting director.

De Havilland 110 Has New Radome

Pointed radome is newest design feature of the de Havilland 110, twin-jet all-weather fighter for the British Royal Navy. Underwing pylons hint at missile armament for the big fighter. Powerplant is a pair of Rolls-Royce Avons rated at better than 10,000 lb. thrust each. Fuselage has tufts mounted on belly in region of wing and dive speed brake for visual observation of local airflow. Long lance-like boom is for flight test pitot and yawmeter. Plane is in production at de Havilland's Airspeed Division plant at Christchurch.

and said 13 million air-carrier and itinerant-aircraft operations were handled by U. S. control towers last year. He said an average of 10,000 instrument flights are made daily and pointed out that less than 1% of all flights are delayed as much as 10 minutes.

Although personnel turn-over declined last year, Pyle said recruiting will be intensified to keep pace with airways activities, which he estimated will double over last year by 1965.

In this regard, he said that, although he is not in full agreement with the new grade structure for controllers proposed by the Civil Service Commission, the proposals represent the first recognition of the need for a readjustment.

The proposals, which will become effective on September 1, if formally approved, sets new pay standards for controllers on the basis of the number of instrument flights handled at a station and the number of controller personnel assigned to the station. The plan is designed to give more recognition to personnel located in busy areas.

Some authorities interpret them to mean that personnel in light traffic areas will be downgraded to reach a wage differential between controllers in less active stations and those at busy stations.

Japanese to Turn Out Own Piston Engine Soon

Tokyo—All-Japanese airplane engine, designed and built by the Kawasaki Aircraft Company, is expected to be turned out soon on an industrial basis for the first time since the war.

Aeronautics Bureau of the Transportation Ministry has granted its first "type license" for Kawasaki's six cylinder, 240-hp. reciprocal engine—the KAE-240.

Vitro to Double Order Backlog; North American Reports Earnings

By Evert Clark

Washington—Vitro Corp. of America, which had a backlog of $43,528,000 on June 30, will soon increase its backlog by another $44 million through extension of a contract with the Atomic Energy Commission.

Vitro's Laboratories Division operates an armament test activity at the Air Force Armament Center, Eglin, AFB, Fla., and research and development laboratories in West Orange, N. J., and Silver Spring, Md.

The West Orange laboratory's work includes a Navy ballistic missile assignment and weapon systems analyses for the Air Force. The Silver Spring laboratory, which will move into a new $1.5 million plant in 1957, also is working on the Navy ballistic missile project.

Missile Ships

It also has systems engineering responsibility for several new Navy guided missile ships and is working on electronic reliability problems, guided missile systems and sub-surface warfare systems.

On July 31, Vitro—which bought 47% of Thieblot Aircraft Co., Inc., in 1955—purchased the remaining 53%. Thieblot, located in Bethesda, Md., develops and produces aircraft components and ordnance systems.

Vitro reported a net income of $263,729 (34 cents a share) for the first half of the year as compared with $140,968 (27 cents a share) for the first half of 1955. President J. Carlton Ward, Jr. predicted "an appreciable increase" in earnings for the last half of the year.

Vitro's contract with AEC will be for the purchase of uranium concentrates. A new agreement reached in late July extends the existing contract from the end of 1958 to March 31, 1962.

North American Aviation

North American Aviation, Inc., reported a net income of $22,322,852 for the nine months ending June 30 as compared with $23,635,000 for the nine months ending June 30, 1955. The 1956 figure is the equivalent of $6.50 a share before the recent stock split, or $3.25 on present stock as compared with $6.88 a share for the 1955 figure. Sales for the nine-month period

NAA Offers New Stock

Los Angeles—North American Aviation Inc.'s board of directors last week voted to offer 1,145,011 shares of capital stock to shareholders at the rate of one for each six shares held. This is a further step in the company's program to raise $40 million for general corporate purposes. Earlier this month, shareholders approved a two for one split of NAA's 6 million shares. The new stock being offered is based on the new figure of 12 million shares. Price for the new shares will not be fixed until about Sept. 6 and the offer will expire on Sept. 24.

totaled $636,741,839 in contrast to $580,381,737 a year ago. Unfilled orders totaled $1,268,271,189 on June 30.

Fairchild Engine Corp.

Fairchild Engine and Airplane Corp. reported earnings of $664,000 on sales of $69,520,000 for the first half of 1956, compared to earnings of $2,108,000 on sales of $78,911,000 in the first half of 1955. Second quarter earnings were $522,000 in contrast to $142,000 for the first quarter. President R. S. Boutelle said three factors contributed to the drop in sales and profits in the first half-year—strikes at the Stratos Division in March and at the Engine Division in April; expenditure of approximately $2,250,000 for research and development expenses, and a changeover in the major product line in one division, which will not reflect favorably in earnings until the last quarter.

In spite of continued heavy expenditures for engineering and development, Fairchild predicted a "somewhat more favorable" second half-year. Its backlog exceeds $200 million. Two major elements in Fairchild's program are the F-27 Friendship 40-passenger turboprop transport and the M-185 four-jet military and executive transport.

Fairchild also announced conclusion of a revolving $20 million credit agreement, extending to Sept. 30, 1959, to replace a V-loan agreement under which the company operated for several years. It was negotiated to meet financial requirements of the F-27 as well as continuing military needs.

All American Engineering

All American Engineering Co. reported an estimated net income of $80,360 (26 cents a share) for the first half of 1956 as compared with $124,797 (46 cents a share) for the first half of 1955. All American is a research and development company specializing in the aeronautical and related fields. President Charles W. Wendt said the second half of 1956 should show "some improvement in earnings as a result of achieving a better balance between cost-plus-fixed-fee and fixed-price production business." Almost all the company's sales for the first half-year were derived from cost-plus fixed-fee type research and development contracts for the armed services. Backlog stands at $4 million now and Wendt said total volume of business for the year will be approximately $5.5 million.

Rocket Spin Will Stabilize Satellite

Third stage of the Vanguard earth satellite will be separated and spun at separation by solid propellant rockets developed by Atlantic Research Corp.

Auxiliary rockets attached to the third stage will rotate that stage and its satellite payload, while the third stage is still attached to the second. After spinning the stages up to full speed of 200 rpm., retrorockets will fire to retard the second-stage shell and positively separate the two stages.

On separation, the spin-stabilized third stage fires to build up from coasting speed to orbiting velocity.

Atlantic Research Corp. is a group specializing in research, development and consulting in the fields of physics, chemistry and general engineering. Offices are in Alexandria, Va.

Col. David Schilling Killed in Car Crash

Col. David C. Schilling, 37, who shot down 23 German planes in air combat and destroyed 10 others, was killed last week when his car skidded into a bridge near the USAF base at Mildenhall, England. Col. Schilling was inspector general of the SAC 7th Air Division in Britain.

Besides his military decorations, which included the Distinguished Service Cross and the Silver Star, Col. Schilling was awarded the Harmon International Air Trophy in 1951.

He made the first nonstop transatlantic jet flight in 1950, flying an F-84 from Manston, England, to Limestone, Me., with three refuelings. In 1952, he flew one of 20 F-84s from California to Honolulu, and was named by the Air Force Association as the man who had done the most for airpower that year.

Same Start, But Much Less Smoke

Both engines on the Air Force B-57 bomber are being started, but the left engine is using an older type solid double base propellant with a plastic binder that fires with a cloud of black smoke. The right engine has a cartridge with an ammonium nitrate base solid propellant that eliminates virtually all the smoke. Starter, for use at rudimentary bases where no ground support is available, is an AS-12 Turbostarter built by General Electric Co.'s Aircraft Accessory Turbine Department at Lynn, Mass. Unit weighs 60 lbs. Besides attracting possible enemy attention, older type propellant also enveloped cockpit in smoke and obscured field visibility if a formation of planes were starting at the same time. Smokeless propellant burns at 2000 to 2200F, lower than older type. It burns out in 10 sec., after which engine takes over and reaches idling speed in 25 sec.

USAF Asks Increase in KC-135 Output

By Katherine Johnsen

Washington—USAF is recommending that the Defense Department program an additional $150 million to accelerate the production of KC-135 jet tankers.

The move, designed to increase the effectiveness of Strategic Air Command's B-52 and B-47 bombers, was disclosed in testimony before the Senate Airpower Investigating Subcommittee by USAF Chief of Staff Gen. Nathan F. Twining.

Gen. Twining, who appeared before the subcommittee in executive session after his return from the Moscow air show (AW July 2, p. 26), said the additional $150 million would come from the $800 million which Congress voted for USAF aircraft and related procurement over and above the Eisenhower administration's Fiscal 1957 budget requests.

Final approval of just how the $800 million will be spent must come from Defense Secretary Wilson, who has assured the subcommittee that the increase will be utilized—if it can be used "economically and efficiently."

Other Plans for Increase

In addition to accelerating KC-135 output, Gen. Twining proposed that the peak production rate of the tanker be raised from 17 a month to 20, the same as the planned peak production rate for Boeing's B-52 intercontinental bomber.

Gen. Twining said the $800 million also could be used for:

• **B-52s.** He proposed that $70 million be earmarked for additional tooling and facilities to increase production capacity for the B-52 to 45 a month. The increased capacity would be placed on a stand-by basis, and the USAF has no immediate plans to accelerate the peak production rate of 20 a month.

• **Long-Lead Items.** Rather than purchasing long-lead items for B-52 production in Fiscal 1958, Gen. Twining would utilize $220 million of the additional Fiscal 1957 funds for this purpose.

• **Guided Missiles.** A recent report, Gen. Twining said, indicates "that funds not previously budgeted may be required in Fiscal 1957 to realize the earliest practical operational capabilities of the intercontinental ballistic missile and the intermediate-range ballistic missile.

"This is evidence," he added, "of what appears to be very satisfactory progress in the development of these new missiles."

Gen. Twining also termed earlier testimony by Gen. Curtis E. LeMay, Strategic Air Command commander, that the Soviets will have a superior strategic air force by 1959 as "questionable." He said it is true, however, that "they will have more heavy bombers."

Bison vs. B-52

As a result of his trip to Moscow, Gen. Twining said he has downgraded Russia's Bison intercontinental bomber.

"The Bison can still do its job for the Soviet Union," he said, "but the B-52 is even better than I thought it was by comparison."

Before the Moscow trip, he had testified that the Bison compared "very favorably with our B-52." At his subcommittee appearance, however, he said:

"I don't think the Bison is quite as good as predicted. Of course, indications are it has the range, but it is not as clean an airplane as I thought it was going to be and there are many protuberances on it."

The General's observations on comparative U. S.-Soviet strategic air striking power included:

• **Soviets will continue** to have more operational Bisons than the U. S. has B-52s "for several years." However, by accelerating production, increasing B-52 peak target production from 17 to 20 a month, "we will overtake them at a later date." He said that, if the USAF achieves its goal of 500 B-52 aircraft in 1958, the comparative Bison and B-52 strength "will be about a stand-off."

• **USAF now has** 1,600 B-47 aircraft in operational units. Gen. Twining said "the Badger is really a later airplane and probably has a little edge on the B-47, except for range. But they are pretty close to being in the same category."

• **Soviet Bear** long-range bomber has "quite an edge over the B-36." Also, the number of Bears in operational units will surpass the number of B-36s in SAC within the near future. "The Bear," Gen. Twining added, "is a much more modern airplane, and it excels the B-36 in speed, and probably range, and altitude is about the same." He said the number of operational Bears now approximates the number of operational B-52s (about 55).

Soviet Supersonic Bomber

Lt. Gen. C. S. Irvine, deputy chief of staff for materiel, who accompanied Twining on the Moscow trip, estimated that Russia is "working toward a prototype stage" in the development of a supersonic long-range bomber. Twining said that U. S. development of a heavy supersonic bomber "is quite a ways off."

If USAF's recommendation to increase the number of SAC wings from 11 to 17 is adopted, Gen. Twining said the Air Force may accept cutbacks in other commands "because of money and the shortage of personnel." With the SAC increase, he said, "we could afford to cut in some other categories—and still have a more effective Air Force."

Gen. Irvine told the subcommittee that Russia gains a production advantage over the U. S. by producing prototypes "in quantities of 30 to 60 for test purposes," while, in the U. S., only a few prototypes are built for first testings.

Lt. Gen. Donald Putt, deputy chief of staff for research and development, another member of the Moscow delegation, said he was impressed by the emphasis Russia is placing upon research and development on materials and materials strength. "They are," he said, "outstanding in their materials field."

Soviet Progress

Other key points made by the generals included:

• **Gen. Twining** said his earlier testimony before the subcommittee that Russian production of day and all-weather fighters of "around several hundred a month"—as against U. S. production of only 10% of this—"still holds." MiG-15 production "ran up around 16,000," he said. A single Nene engine plant, he said, produced over 10,000 engines for the MiG-15 during the Korean war. Gen. Irvine noted that "they got into production on that (British-developed) engine in less time than Pratt & Whitney did, and, instead of duplicating the engine as Pratt & Whitney did, they increased the output 25%. However, Pratt & Whitney was concentrating improvement-wise on creating an axial flow engine."

• **Russian refueling developments.** Gen. Twining said Soviet officials "told me that refueling increased their radius 30%, two refuelings would increase it 60, and they were very much interested in two types of refueling, the rigid and the flexible type. . . . They said they preferred the flexible type, so there is no question about them working on it, but we saw no real evidence of their refueling technique."

• **Gen. Putt reported** he "was astounded at the numbers of air force officers that they are giving a very fine technical training, and one must therefore conclude that the people who are also in the design bureaus, their civilian scientists and technicians, must be getting an equal or better training to do the jobs that they have to do."

• **Russia's transonic bomber** (the Blow

Torch) "looks better," Gen. Irvine said, "than anything we have in our inventory in the light bomber category. However, I am sure our B-58 will be much better.

In the fighter category, our F-104 is better than anything we saw."

• **Outstanding production performance** of "crummy looking" plants in Russia was noted by both Gen. Irvine and Gen. Putt.

Gen. Irvine observed: "One machine shop was filthy. I looked at the machine tools, and they were the same as I was responsible for building our engines with in World War II. Many of the machine tools were 1940 design. But on those machine tools they built over 10,000 engines of high quality, and in the areas where it was important, the final assembly line for the engine, the housekeeping was beautiful. . . .

"They do not have an inspection system as we know it. Instead of having one man for each three in a plant as inspector, their inspection system is the final assembly. Every part is marked with the code of the man who made it. If the part doesn't fit on assembly, something happens. They always need people in the mines, they said."

• **On engine development,** Gen. Irvine reported: "Nothing we saw was any different or any better than what we are doing. I think in detailed engine design, those things which give you range, they are still behind us. But in those things which give you straight horsepower, such as our development program with General Electric on the J53 engine, they are making progress. However, we stopped that development. The Russians went ahead and built such an engine."

• **Overall, Gens. Putt and Irvine** estimated that Russia is "about three years behind us, at the outside" on aircraft development.

"I can only come to one conclusion," Gen. Irvine said, "that in such areas as ballistic missiles, nuclear bombers, chemical bombers, long-range interceptors, we must do everything we can in marshaling the people and resources into those programs to the fullest extent. . . .

I think it is possible they might be ahead (in some of these fields) because of some of the things we observed." In the fundamental fields of electronics and metallurgy, he added, Russia appears to be "as good . . . possibly better" than the U. S., but "they are not as good as we are in production engineering."

Army Lets Five Study Contracts To Probe Flying Crane Capability

Washington—U.S. Army's shifting areas of interest in rotary-wing aircraft have led to five new contracts for an extended study of the state of the art as applied to "flying crane" cargo movers.

The program is attributed in large part to abandonment of the Vertol H-16 tandem transport helicopter project.

The H-16, originally an Air Force project and later financed entirely with Army funds, was abandoned several months ago. The reason given by the Army was the anticipated high operating and maintenance costs.

Five contracts for design studies in the flying crane field have been awarded to exploit various approaches to the problem with emphasis on easy maintenance, reliability and the ability to operate under artic to tropical conditions.

Flying Crane Contractors

Total value of the contracts is $264,900. They were awarded to:

Fletner Aircraft Corp., Kew Gardens, N. Y., $39,600; Kaman Aircraft Corp., Bloomfield, Conn., $41,800; Piasecki Aircraft Corp., Philadelphia, $58,800; Hughes Tool Co., Aircraft Division, Culver City, Calif., $54,700, and Hiller Helicopters, Palo Alto, Calif., $70,000.

Goal of the Army program is a heavy-lift design capable of carrying up to 16 tons of cargo. Present helicopters have a capacity of three to five tons.

Army spokesmen made it clear that earlier designs in the flying crane field have been feasible but would result in excessive costs, mechanical complexity and tough logistical problems in support of the aircraft.

Major projects already under way and dating back several years include the Hughes XH-17, an Air Force project, and the McDonnell Aircraft Corporation's XHCH-1, designed for the Navy as a cargo unloader.

Hughes' Design

The Hughes design is the only one that has resulted in flying hardware. Powered by tip pressure jets, the aircraft is hampered in the Army's opinion by a heavy landing gear that makes up 10 to 20% of the helicopter's gross weight. It is anticipated that the new designs will utilize a suspension method of carrying cargo, eliminating the need for a conventional landing gear.

The original Hughes design had a two-bladed rotor. A later version that incorporated a four-bladed rotor was proposed by the manufacturer. It was designated the XH-28.

McDonnell's flying crane, the XHCH-1, was first announced in 1951. Activity has been resumed, and the manufacturer is conducting whirl tests of a rotor configuration with small pressure jets at the tips. There are three blades.

Payload of the XHCH-1 is understood to be more than 12 tons.

Why Renewed Interest

Army spokesmen say their renewed interest in a flying crane is part of their exploration of the problem of increased mobility. They need a carrier to shift large bulk items of critical cargo for distances of 10 to 100 miles. Frequently there are terrain barriers, lack of adequate landing spots and no highways.

In addition, heavy lift capacity is needed in many emergency operations. These include the recovery of aircraft forced down in inaccessible areas, the laying of bridge sections, clearing wreckage from highways and moving critical cargo from ship to shore.

No final decision has been made, however, to procure a flying crane. More design studies may be ordered from other manufacturers. Then there will be an evaluation of the ideas, much of it in cooperation with the Air Force and Navy.

Orders may follow if it is decided that the state of the art has advanced to the point where Army funds can profitably be invested in a development project.

T53 Turboshaft Passes 50-hr. Pre-Flight Test

The XT53-L-1 turboshaft has passed its 50 hr. pre-flight qualification test. Lycoming Division of the Avco Manufacturing Corp., Stratford, Conn., the manufacturer, said this makes the XT53-L-1 the first gas turbine designed specifically for helicopter application to qualify for a military production contract.

The 825 hp. (military rating), 460 lb. engine is a free turbine type with the drive shaft concentric with the gas generating section shaft so that the power take-off is from the front end—the end at which the air flow enters after the convention established by turbojet engine. This configuration should make the engine attractive for turboprop applications as well as the Bell Aircraft H-40 for which it was designed.

The T53 has taken over three years to develop. The creative work was under the direction of Dr. Anselm Franz formerly with Junkers Jumo, Germany.

Beech Flies Light Twin Badger

Flight service test program has begun for Beechcraft Badger, a four-place twin-engine executive airplane (AW Aug. 13, p. 39). Badger, powered by two 180 hp. Lycoming engines, will cruise at 200 mph. Name chosen by Beech Aircraft Corp. reflect qualities of American Badger as "tough fighter, capable of meeting all competition," also reflects purpose of meeting competition of Cessna 310.

CAA Civil-Pilot Census Puts Total at 298,076

Washington—Civil Aeronautics Administration, in its first official count of pilots holding licenses with unexpired medical certificates, announced last week that there were a total of 298,076 active civil pilots in the U. S. on Jan. 1.

The survey represents a four-year program to collate current medical certificates with the 724,638 pilot licenses which the CAA has on file. Although a pilot license or proficiency certificate does not expire, no pilot may fly without a current medical certificate.

Breakdown of active proficiency certificates on record shows 80,494 student, 132,525 private, 72,957 commercial and 11,774 airline transport pilots.

Instrument flying ratings have been issued to 19,741; flight instructor ratings to 28,108.

The count also revealed that there are 91,001 mechanic certificates in effect, 27,080 for ground instructors, 17,483 for registered control tower operators and 4,349 for flight navigators.

Other certificates outstanding: 2,859 for parachute riggers, 2,518 for dispatchers, 1,602 for flight navigators and 1,047 for flight radio operators.

Active and Total Pilots by States

(As of January 1)

	Active	Total		Active	Total
Alabama	2,702	7,948	Nevada	1,015	2,436
Arizona	3,431	8,187	New Hampshire	883	2,460
Arkansas	2,265	8,077	New Jersey	8,103	17,188
California	37,960	88,355	New Mexico	1,860	4,512
Colorado	4,139	10,471	New York	18,543	39,639
Connecticut	3,459	7,369	North Carolina	5,291	11,687
Delaware	684	1,487	North Dakota	1,601	2,992
District of Columbia	1,253	3,241	Ohio	15,025	36,774
Florida	9,804	23,429	Oklahoma	5,746	15,626
Georgia	4,131	10,784	Oregon	4,584	13,103
Idaho	2,277	7,499	Pennsylvania	13,813	34,772
Illinois	17,773	39,800	Rhode Island	843	2,341
Indiana	8,703	21,212	South Carolina	1,912	5,849
Iowa	6,903	16,669	South Dakota	2,188	4,586
Kansas	6,225	15,676	Tennessee	3,703	9,624
Kentucky	2,777	7,465	Texas	19,792	48,665
Louisiana	3,501	8,455	Utah	2,409	6,435
Maine	1,459	3,966	Vermont	580	1,549
Maryland	3,007	6,797	Virginia	4,785	9,985
Massachusetts	6,641	16,654	Washington	7,822	21,520
Michigan	12,296	32,842	West Virginia	1,893	5,209
Minnesota	7,713	16,657	Wisconsin	5,513	14,409
Mississippi	1,863	4,859	Wyoming	1,253	3,068
Missouri	7,044	18,268	Outside Continental		
Montana	2,470	6,118	United States	4,477	7,748
Nebraska	3,962	10,176		298,076	724,638

SIX FALCON MISSILES ARE IN FIRING POSITION ON WING TIP POD OF F-89H, FIRST OPERATIONAL AIRPLANE TO CARRY

F8U to Bid for Thompson Trophy; Pentagon Puts Ceiling on Speed

By Claude Witze

Washington—Chance Vought's F8U Crusader, operating under Defense-Department-imposed restrictions that will keep its speed within the area of 1,000-mph., will seek a new U.S. record in the National Aircraft Show's Thompson Trophy event.

The Navy aircraft, however, will not be allowed to try to better the official world speed record of 1,132 mph. set by a British research plane, the Fairey Delta FD2.

This achievement corresponds to the 1,900 mph. recorded last month by Lt. Col. Frank K. (Pete) Everest in the Bell X-2 but never formally confirmed by either the Air Force or Defense Department.

The record the F8U will attempt to break in the Thompson event on Labor Day will be the 822.266-mph. pace set last year by the USAF's Col. Horace A. Hanes flying a North American F-100C Super Sabre.

Token Demonstration

Like last year, the Thompson Trophy dash at the National Aircraft Show in Oklahoma City will be only a token demonstration. Actual test run probably will be made this week at Edwards AFB, Calif., over a measured course and monitored by the National Aeronautic Assn. Pilot for the test will be Cmdr. R. W. (Duke) Windsor of the Navy Air Test Center at Patuxent River, Md.

Back of the decision to demonstrate this F8U lies many months of wrangling over Defense Department insistence that military aircraft performance be kept secret and that operational planes be kept out of competitive speed runs. Previous attempts to set a record with the Crusader have been forbidden by the Pentagon, acting on direct orders from Defense Secretary Charles E. Wilson.

Key man in the partial breakdown of this Defense Department policy appears to be Adm. Arleigh A. Burke, chief of naval operations.

Navy Secretary Charles S. Thomas, prodded by Adm. Burke, made three appeals to get the F8U in the Thompson event before he was successful.

On the first two tries, Thomas received flat rejections to his proposal. In the third case, Secretary Wilson appointed an *ad hoc* committee to consider the situation. Headed by Assistant Defense Secretary Robert Tripp Ross, the committee consisted of two officers from each of the armed services.

Recommendation Accepted

Their recommendation that the Navy be permitted to enter the Chance Vought carrier plane was accepted.

The aircraft will not be permitted to demonstrate maximum speed in conformance with Wilson's policy edict against announcement of aircraft performance before a plane has been in operation for a year. The restriction was hung on the show despite a plea by Thomas that the F8U has been operational almost a year.

This year's Thompson Trophy event marks the first time in the history of the 27-year-old event that a Navy aircraft has been entered. Before the ban on closed-course racing that changed the National Air Races into the National Aircraft Show in 1950, Navy planes that had been retired were flown by civilians.

Outstanding were a number of Corsairs, also designed by Chance Vought but built by Goodyear, that were entered by Cmdr. Cook Cleland, then a reserve officer.

Cmdr. Cleland won in 1947 and again in 1949.

Soviets Rehabilitate Wilbur and Orville

Correction, Comrades: Mozhaisky wasn't the inventor of the airplane.

Russian aviation history has just done a 180-deg. turn from its long-held claim that Alexander F. Mozhaisky built and flew a man-carrying airplane on July 20, 1882. There was such a frightful storm, according to weather records, that any early airplane would have been unable to stand the strain. Furthermore, Comrade M. wasn't even in the country when he was supposed to have been building his airplane.

This correction to rewritten history was made by "Questions of History," an official Soviet publication which establishes the correct historical perspective for this and other weighty matters. Two writers—I. Shipilov and N. Cheremnich—got the back of the journal's hand for making up facts in the book they wrote about Mozhaisky. Their book, published in 1949, was full of falsehoods; its revised edition of 1955 was even worse, according to the magazine.

THE AIR-TO-AIR MISSILE. BESIDES FALCONS, F-89H CARRIES 42 2.75 IN. ROCKETS. F-89D CARRIED 104 AIR-TO-AIR ROCKETS.

News Digest

Air samples from 75 mi. altitude, collected last week in nose cones of Navy Aerobee rockets launched from White Sands Proving Ground, will be analyzed at University of Michigan and Max Planck Institute for Chemistry, Mainz, Germany. Steel bottles inside nose cones of six rockets opened at peak altitudes, and then snapped shut, collecting eight quarts of air. At normal density, this air would take up less than 1 cu. in.

Borgward Motor Co., Bremen, Germany, will start next month on development of Germany's first postwar helicopter. Professor Heinrich Focke will return from Brazil to lead design team.

Royal Canadian Navy is spending $170 million on aircraft carrier program. Included are $26 million for new carrier, HMCS Bonaventure, and $143 million for aircraft, among them 39 Banshee jet fighters bought in the United States for $27 million and 100 CS2F anti-submarine aircraft built by de Havilland Aircraft of Canada.

Boeing Airplane Co. is studying several plant sites in San Francisco area, including idle Chrysler plant at San Leandro, Calif.

Nine jet engine test facilities capable of accommodating turbojets of 30,000-lb. thrust will be built for Navy by Kittell-Lacy, Inc., Los Angeles, for installation at nine Navy bases.

AD7 which is 50th version of Skyraider series, has been delivered by

FALCONS, extended in this closeup on ground, are concealed within wing pod on takeoff and in flight to target. Just prior to firing they are extended. Each pod carries three Falcons and 21 2.75 in. rockets, installed in clusters of seven behind frangible fairings. Northrop Aircraft said that the installation of the 6-ft. 100-lb. Falcon missile makes the F-89H the heaviest intetceptor in U. S. service. Both the Falcon and the rockets can be fired selectively, enabling the F-89H to make several passes at target. Production versions of the F-89H are coming off Northrop's final assembly line at Palmdale, Calif. Powerplants of the F-89H are two Allison J35-A-35 turbojet engines with afterburners. Carrying a two-man crew, it has a maximum takeoff weight of more than 40,000 lb., operates at altitudes above 45,000 ft. Speed is in 600-mph. class. Sighting radar and fire control computer make up automatic attack system. Armament is triggered electronically. Range is over 1,000 mi.

Douglas Aircraft Co., to Navy. It is powered by improved Wright R-3350-26WB engine.

Flight tests and analysis of L-23 aircraft to determine how drag could be reduced by reducing local airflow disturbances caused by surface irregularities and protuberances will be made by Mississippi State College under Army contract.

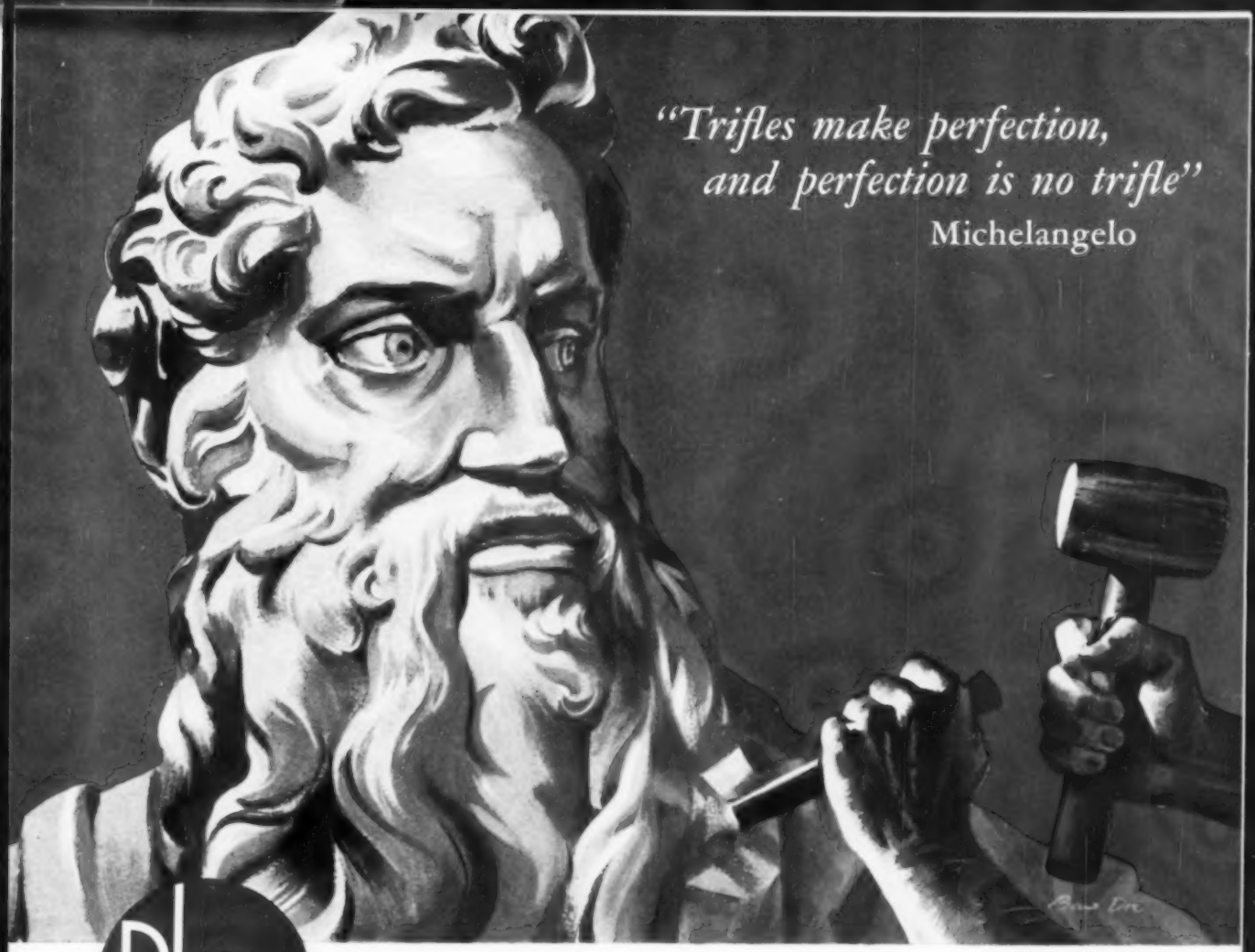
Douglas B-66 twin-jet bomber flew 2,690 mi. from Hawaii to Long Beach, Calif., in four hours, 27 minutes. The aircraft, returning from Eniwetok H-bomb experiments, averaged more than 600 mph.

USAF's 27th Strategic Fighter Wing, Bergstrom AFB, Texas, will be the first Strategic Air Command unit to receive supersonic fighters. McDonnell F-101 Voodoo will start replacing Republic F-84 in October.

Maj. Gen. Arthur R. Wilson, U. S. A. (ret.), a former Trans World Airlines vice-president, died Aug. 11 at Letterman General Hospital in San Francisco. Wilson, a member of Gen. Dwight D. Eisenhower's staff during World War II, retired from the Army in 1946 and joined TWA. He was the first director of the Trans World's European Division when it was originally formed in 1946, he left TWA in 1947.

Valiant Mounts Rocket Engines

Super Sprite rocket engine for assisted take-offs is shown in flight-test installation on a Vickers Valiant medium bomber. Super Sprite was designed and developed by de Havilland, was first British rocket engine to be cleared by Ministry of Supply for production and for civil use after passing type tests. Engine uses a cold cycle to develop its 4,000-lb. thrust. Hydrogen peroxide is decomposed in the combustion chamber to produce a jet of superheated steam which can be augmented by afterburning of the kerosene or gasoline. Note in the closeup of the installation that external stiffeners have been riveted to the Valiant tailpipes in the region of the rocket blast, and that marks, presumably of temperature-indicating paints, stripe the outer surface of the exhaust cones. Super Sprite powerplant packages can be jettisoned from the aircraft after takeoff (AW Nov. 8, 1954, p. 40). Small protruding airfoil on inboard side of each rocket pack presumably is a vane to guarantee separation on ejection. Valiant installation was made by de Havilland who received the airplane on loan from Ministry of Supply as a test bed.



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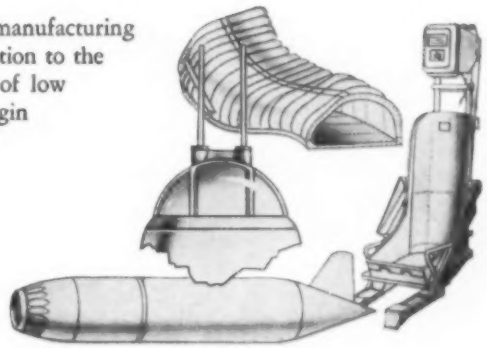

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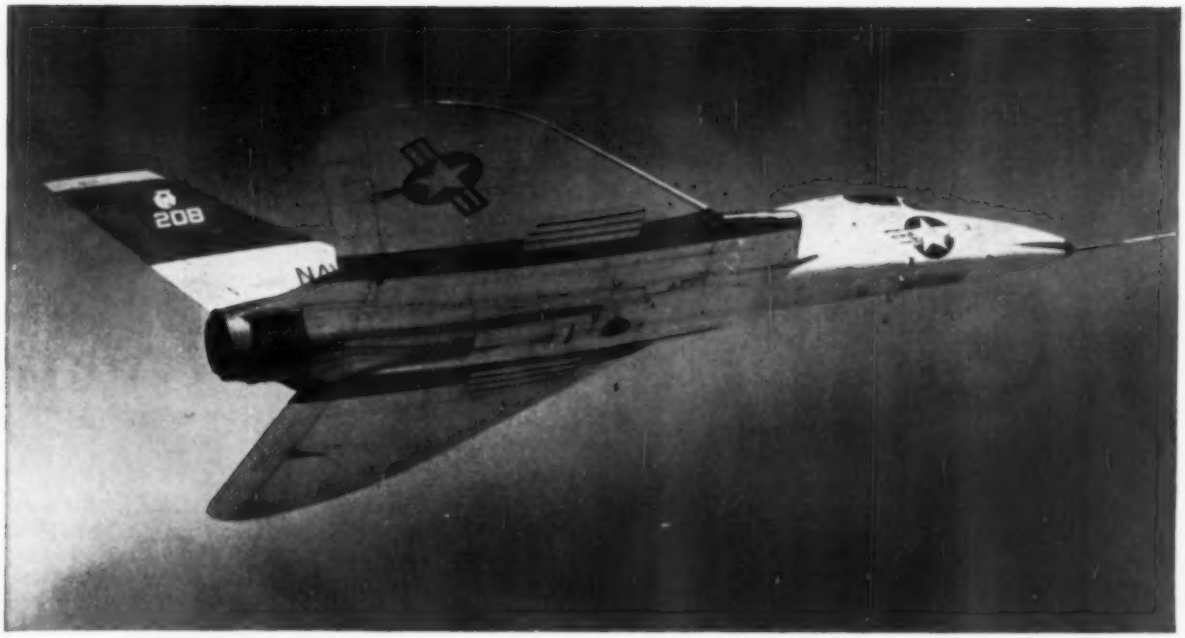
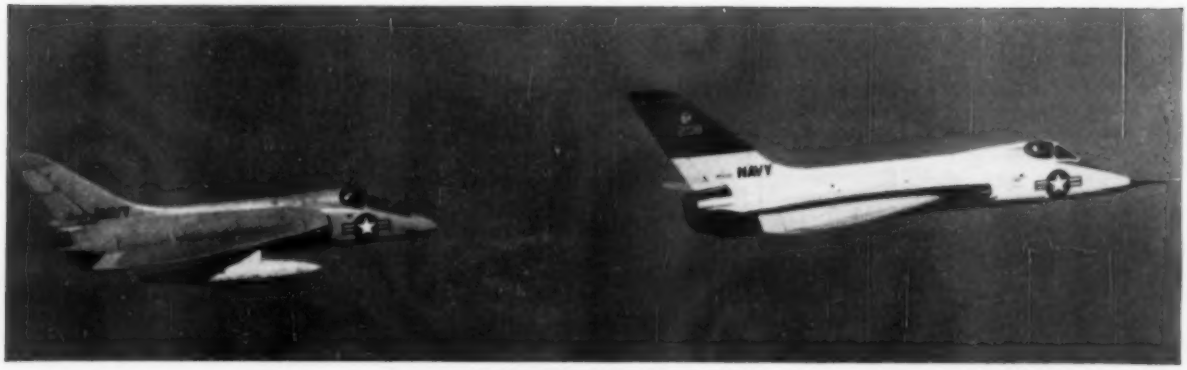


Two New Models: F5D, F-100F

XF5D Skylancer (top and with predecessor, F4D Skyray, bottom) has same general planform as F4D. However, wing is thinner and fuselage is longer, tapering to thinner nose section forward and to larger engine nozzle aft. Engine is more powerful version of J57 turbojet. Vertical tail is larger, and cockpit has V-shaped windshield.

Extensive use of integrally stiffened wing skins milled from aluminum alloy plate permits wings to double as self-contained fuel tanks. With fuselage tank, F5D has more speed and longer range than F4D. F-100F (right) is two-place model of Super Sabre. In production for USAF, it is longer than F-100D but can perform same tactical missions at same high speeds of earlier models. Second place may be occupied by student for training or observer for bombing missions. Powerplant is also J57.



Northeast Wins New York-Florida Battle

CAB awards New England line New York-Miami route as part of plan to bolster small trunk carriers.

By Craig Lewis

Washington—Northeast Airlines has won the bitter New York-Florida route battle, with the Civil Aeronautics Board giving it the nod to supply new competition for Eastern Air Lines and National Airlines.

The decision to expand Northeast's routes to the south is another step in CAB's campaign to strengthen the smaller trunk airlines. It gives the New England carrier its big chance to grow into true trunk line status and to get off subsidy.

The CAB's choice was made public in a press release issue under a new policy (see box) designed to eliminate news leaks and rumors that always have occurred when major route cases have been decided.

Awards and Alterations

Here are the route awards and alterations made in the New York-Florida decisions:

- **Northeast Airlines** will get a new route from New York/Newark to Miami via Philadelphia, Baltimore, Washington, Jacksonville and Tampa for a temporary period of five years.
- **National Airlines'** route will be extended to Providence and Boston, and the carrier will be permitted to operate turn-around service in the Richmond-Washington-Baltimore-New York-Boston market. National will be allowed to carry local passengers between Philadelphia and New York and will have permanent authority to serve Newport News-Hampton-Warwick, Va. It will be allowed to operate between Washington and Baltimore, and Norfolk and Newport News-Hampton-Warwick. Fayetteville, Greensboro-High Point and Winston-Salem, N. C., will be added to National's New York-Miami route.
- **United Air Lines and Trans World Airlines'** eastern terminals will be linked so the carriers can serve Boston, New York and Washington on the same flight with long haul restrictions. United and TWA can serve Hartford/Springfield as an intermediate point between New York and Boston.
- **Eastern Air Lines** will be relieved of restrictions which require that flights serving Boston originate or terminate beyond Richmond, Va., or Charleston, W. Va., and that Providence, Hartford/Springfield and New Haven be served only on flights between Boston and Richmond or Charleston or beyond. Eastern will be permitted to operate turn-around service between Tampa/St. Petersburg and Miami, and will be able to offer nonstop service between Tampa/St. Petersburg and points on its New York/Miami route.
- **Capital Airlines** will be permitted to serve Norfolk and Newport News-Hampton-Warwick on flights serving New York, Philadelphia, Baltimore, or Washington.
- **Delta Air Lines** will be able to operate one-stop service between Tampa and western points on Route 54 (Chicago, Cincinnati, Knoxville).

Effective Date

The new routes and operating authorities granted in the New York-Florida Case will become official when the Board issues its order and opinion, probably in about a month. Meanwhile, CAB has made public the main points in its decision in an effort to solve its security problem.

In spite of the fact that the decision was made public, a news leak tipped off Wall Street, and Northeast stock rose several points in the week before the Board issued its press release. In the future, CAB hopes to announce its decision quickly enough to forestall leaks and rumors.

New CAB Policy

Civil Aeronautics Board has adopted a new policy of announcing its decisions in route cases as soon as they are made. The new plan is designed to avoid the information leaks that have plagued the Board in the past.

Under the new policy, the CAB will issue a press release when it decides a case and issue the opinion and order later after the staff members have written them. Formerly, results of route cases did not become public until the opinion was written and issued—sometimes two months after a case was decided. News of the decision inevitably leaked out in this period, with resultant effects on the stock market and pressures on the Board to change its mind.

Just before the New York-Florida decision was released, CAB launched its new policy with releases on the Florida-Texas and Erie-Detroit cases. National was chosen to operate a direct service between Miami and Houston for three years. In the Erie case, the Board decided to extend Allegheny Airlines' route from Erie to Detroit, Mohawk Airlines' route from Buffalo to Detroit via Erie, and Lake Central Airlines' system from Youngstown to Erie, all for a five year period.

Choice of Northeast for the heavily traveled New York-Florida route follows closely the philosophy which developed in the last four months of 1955 in a series of major route cases.

Stronger Trunk Lines

In these cases, the Board said it wanted to strengthen the smaller regional trunk airlines so they would be more potent competitors with the Big Four. In rewriting the competitive pattern of the domestic airlines, CAB chose a small carrier for a new route wherever possible and repeatedly said it wanted to narrow the size gap between the Big Four and the rest of the trunk airlines.

Since this series of decisions was issued, the composition of the Board has changed. Two of the three-man majority that backed the new philosophy most heavily—Ross Rizley and Josh Lee—have been replaced by James R. Durfee and G. Joseph Minetti.

Now it appears that Durfee, Minetti and CAB Vice Chairman Joseph P. Adams have taken up where Adams, Rizley and Lee left off. It is understood that Northeast won its new route on a 3-2 split vote, with Durfee, Adams and Minetti favoring the New England carrier. If this combination continues to prevail, the approach to airline competition developed last year will continue to guide the Board in the important route cases now coming up.

When CAB picked Northeast, it reversed the recommendation of its examiner, who favored Delta for the route. The Board also overrode the examiner's disapproval of Northeast's relationship with the Atlas Corp. which holds 50.97% of the airline's stock.

Tough Competition

Northeast has a tough job ahead of it in breaking into the New York-Florida market. Eastern and National are highly skilled competitors.

A major problem will be equipment.

Britannia Arrives at New York

Bristol Britannia arrives at New York International Airport on first leg of promotional tour which will take the big turboprop airliner to eight United States cities and to Canada. The series 100 plane, now wearing blue-and-white Bristol Aircraft markings, is scheduled for London-Johannesburg service this fall under British Overseas Airways Corporation colors. It was demonstrated in flight at Idlewild before departing for San Diego non-stop. Bristol has fitted the aircraft with both high-density and luxury features to show it off to potential customers. Forward seating is six-abreast tourist configuration. Lounge and cocktail bar aft are included as in a first-class version. The Port of New York Authority, which bars turbojets at present noise levels from Idlewild, has had no difficulty with the turboprop Viscount and finds the impressively quiet Britannia quite acceptable. Bristol managing director Peter Masefield heads the Britannia task force

Right now the airline owns 12 DC-3s, six Convair 240s and leases a DC-4 and a C-46 which has been modified as a passenger transport. While the New York-Florida case was in process, Northeast ordered 10 DC-6Bs, and delivery is scheduled to begin in January. The airline said it would buy jets as soon as it got the route.

The DC-6Bs will bring a marked improvement in Northeast's fleet, but even then the airline will be at a disadvantage, with Eastern and National operating DC-7s and Super Constellations. Both of the larger carriers also have Lockheed Electras and DC-8s already on order.

Vital Factor

A vital factor in Northeast's chances of meeting its competition properly will be Floyd Odlum's Atlas Corp. and the amount of backing it gives the airline.

The carrier will need heavy financial support to get the equipment and installations it needs.

One of Northeast's big selling points was the fact that a New York-Florida route would give it a chance to get off subsidy. During hearings in the case, Northeast estimated that if it flew the route during 1956 it would participate in a total market of 2.5 million passengers, would have revenues of $31,289,000 and would make a profit of $4,073,000.

In 1955, Northeast's revenues totaled $10,120,300, including $1,572,513 in subsidy. Net profit for the year was $379,937.

Airline, Manufacturer Views Vary on Turbine Transports

By Richard Sweeney

San Diego, Calif.—Airline operators and airframe manufacturers who opened the Institute of Aeronautical Sciences National Turbine-Powered Air Transportation Meeting here last week discussed the merits of turboprop versus turbojet engines for airline operations and disagreed on the effect turbine engines would have when they were introduced.

Peter Masefield, managing director of Bristol Aircraft Co., who flew to the West Coast in Bristol's turboprop Britannia, told several hundred registrants that Bristol sees a long life for turboprops.

Turboprop Advantages

Turboprops have a great deal of possible growth in them, he said, with Speeds of over 500 mph. attainable in later versions. Another plus factor is that handling and pattern characteristics are not too far removed from the flexibility of piston powered transports. He cited a 20% lower direct operating cost for turboprops over piston or turbojet planes of the same capacity. He said it will take longer than now believed to solve the turbojet problems of:

- **Air traffic control.** Congestion is already heavy and will be aggravated by the turbojet inflexibility.
- **Runway inadequacies.** This concerns runway length and strength.
- **Icy runway hazards.** Turboprops can use reverse pitch but turbojet thrust reversers are not yet perfected.
- **Smog area difficulties.** Water injection takeoffs increase the amount of smoke from turbojet engines.
- **Loud noise.** A natural part of increased power.

Communities will be hostile, Masefield said. (But he did not refer to noise suppression investigations being conducted in America which promise eventual success.)

Maynard Pennell chief engineer of the Boeing Airplane Co. Transport Division termed the step more of one to bigger and better equipment than of radical change. He said there are turbine bonuses in scheduled transport service, listing them as no more carburetor troubles, ignition troubles or propeller problems. Similarities between the transports are greater than the differences, Pennell said.

Less Congestion

Pennell said the air traffic congestion will be relieved since fewer planes will handle greater workloads than are possible with today's piston powered transports.

He said that as engineers develop, airlines will need fewer manhours of

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maintenance per hour of flight time for turbojets than piston planes.

In structures, he saw less maintenance, and training of maintenance personnel and flight crews promises no more difficulty than the stepup from DC-3 to DC-4 -6 and -7 types.

Douglas Aircraft Co., use of a simulator to train flight crews before the DC-8 itself will be ready to fly was described by Ivar Shogran, DC-8 project engineer. Added quality has been given the simulator by including closed circuit television which produces a view like aircrews see during landing and takeoff through the windshield. Small models of existing airports are used for the television presentation.

In addition, motion has been introduced by hydraulics to the flight crew stations, the same as those in flight maneuvers as turns, climbs, dives, turbulence, and other aircraft motions.

Shogran also told of development by Douglas engineer Harold Klein of a "bloaway jet" unit which neutralizes vortex effects of air drawn up from the ground into jet intakes. Attached to the nacelle underside and pointed 70 deg. downward, the jet uses engine bleed air, and prevents foreign objects from being picked up into intakes by destroying the intake vortex.

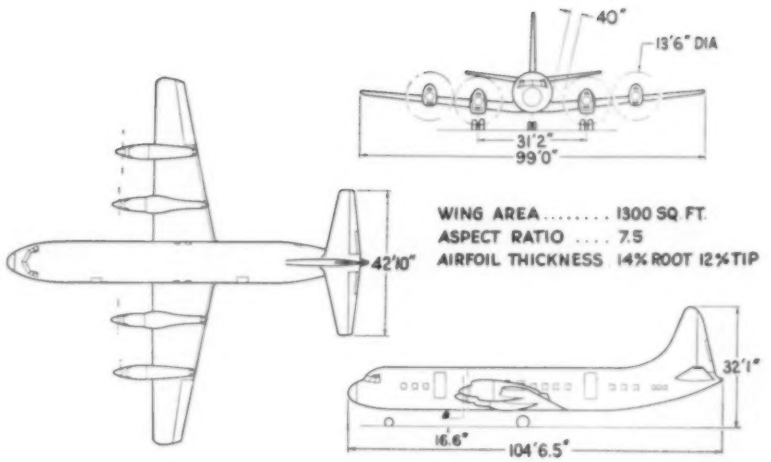
Lockheed feels its Electra turboprop is just another new airplane, with problems of introduction similar to those experienced with piston powered planes, M. C. Haddon, chief engineer of Lockheed's California Division, said. He cited company experience with the military version of the Allison 501-D13 Electra powerplant on the C-130 transport, as well as experience with the Pratt & Whitney T34 in four test bed Constellations for USAF and the Navy.

Constant Speed

Haddon cited the advantages of constant engine speed, of propellers as transfer agents between engine power and movement of vehicles through the air in lower speed ranges, and provisions Lockheed is making in its Electra design which will permit greater than normal utilization possible along with good potential growth.

Greatest need, according to Haddon, is to obtain detailed knowledge on the difference between turboprop powered transports and piston powered transports, then plan the utilization to take advantage of the turboprop's inherent advantages.

Speaking for Convair, Joseph Famme, assistant chief engineer, said the greatest need is for an airplane with simplicity and reliability built into it, along with passenger comfort. Pointing out that speed has been the factor looming largest in new plane introduction, he said Convair is shooting for high speed, and—as was the case with the twin engine Convair-Liner—is again seeking to fill the medium-short range bill with its Model 880 jet transport.



LATEST Electra three-view shows minor differences from earlier versions. Dorsal fin is larger, rear door is further forward and tail cone protrudes.

Famme said he wasn't sure whether commercial planes had to wait for engines from the military, or whether they were fortunate enough to be able to wait until the military developed the powerplants.

Ground Equipment

American airline's Marvin Whitlock took issue with the airframe people, calling introduction of turbine planes a new era of air transport. Increased flexibility will make almost anything possible in design if the carriers make up their minds exactly what they want, he said.

Airlines need ground equipment for passengers and planes equal to the planes' potential, Whitlock said, instead of having the same systems of ticketing, food and baggage handling and plane service used on DC-3 transports. He said cities also need to look to their airports, that they will need runway lengths proportional to the distances they want covered by flights originating in their city.

American still feels the main base maintenance concept will be best, with jet airplanes utilized mostly from 9 A.M. to 11 P.M. daily for flights. To train for maintenance of these new airplanes and flight operations, the line will plan its training aids program more thoroughly, so that its people will remember simultaneously what they know of piston planes and add the knowledge necessary for jet work.

William Del Valle said Pan American World Airways feels the degree of change has been over dramatized, that many things not thought possible for jets have been achieved. He called for better plumbing in planes and for self contained airplanes for use in remote areas of the world. He approved the similarity between 707 and DC-8 cockpits, but called for more integration of flight attitude and aircraft navigation and position information. Also needed, he said, is more accurate air data, which has an important influence on plane performance, inflight changes of route, altitude and other flight plan segments.

A provision for old-fashioned top of the wing refueling along with the single point high pressure systems was listed as a must for flexibility in remote world area operations.

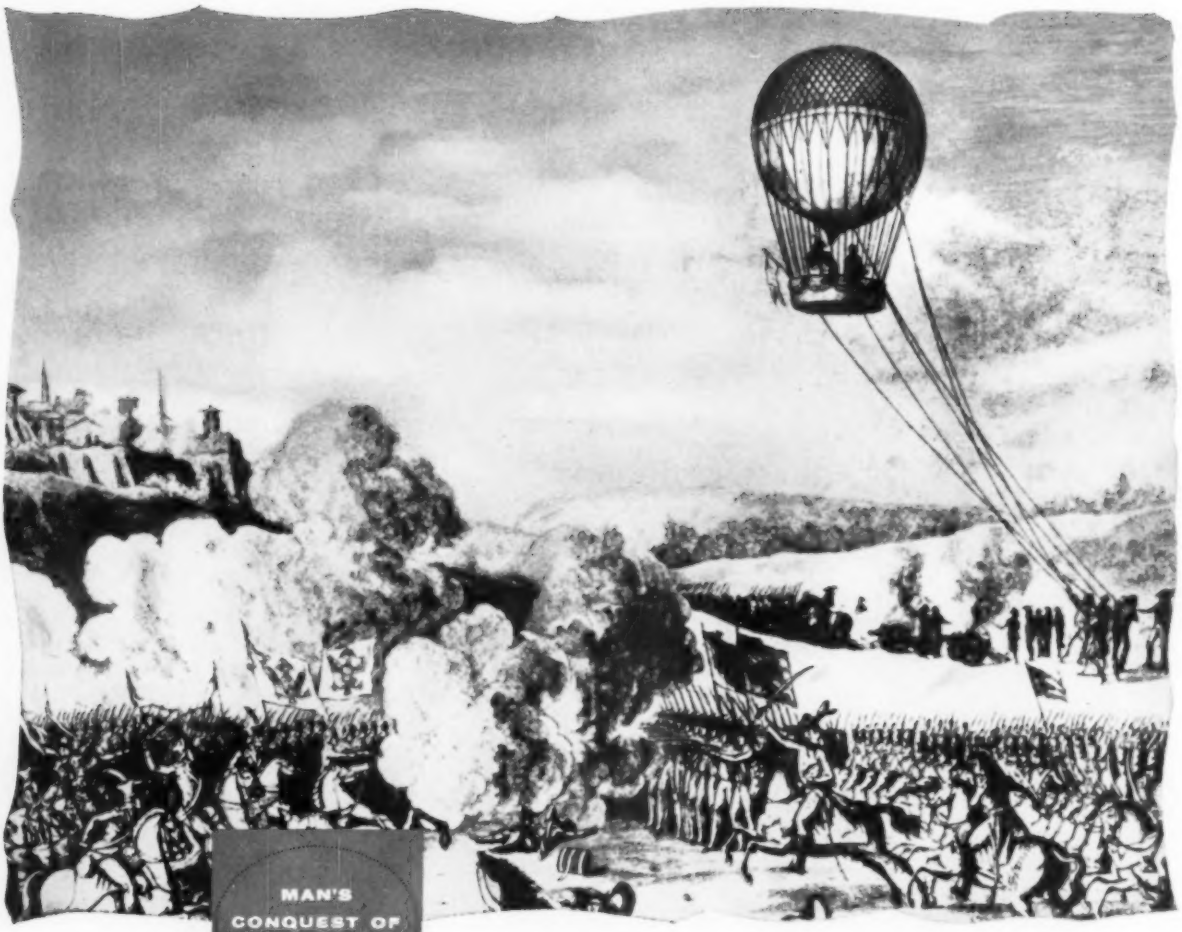
Ground Needs

Speaking for United Air Lines, Joseph Metzner agreed generally with the just-another-new-airplane school, and added that the crying demand is for better ground services for passengers, plane loading and unloading and servicing, to complement jet capability. He told of United using a committee system to plan new plane introduction, with all departments affected playing a part.

He called for more realism by manufacturers in their performance figures, using real temperatures instead of the NACA standard day; which never happens, and for more true appraisals of performance at high temperatures in cruise regimes as well as on the ground.

Another area needing more realism, Metzner said, is engine manufacturer claims of engine specifics in fuel consumption. More realistic data on engine power deterioration with age and foreign matter ingestion also is needed, he said.

In the question and answer session, problems of manufacturers in meeting contradictory airlines' specifications were decreased. Differences in fuel also were pointed out, with no real all-airline specification for turbine engine fuel yet set up.



MAN'S CONQUEST OF THE AIR

First aerial observation of battle

Undoubtedly an important factor in the victory of Napoleon's forces at the Battle of Fleurus in Belgium in 1794 was, believe it or not, aerial reconnaissance. For in this battle Captain J.M.J. Coutelle—"Captain of Napoleon's Aerostiers"—became the world's first military balloon observer. For hours Coutelle's balloon hovered over "no man's land" and even over the enemy's lines. With signal flags he and a companion relayed vital information back to the French Army Commander.

Coutelle continued his aerial reconnaissance for Napoleon at Mayence in 1796 and elsewhere. But in Egypt, where he had been ordered in 1798, his balloon equipment was finally destroyed in a naval battle.

Man's conquest of the air has come a long way from the uncontrollable balloons of yesterday to the sleek, earth-circling giants of today. Since the advent of powered flight, Esso research has helped speed the progress of aviation by creating new and improved fuels and lubricants for military and commercial aircraft.

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CAB Proposes Special Policies For Jet Transport Certifications

Washington—Special performance requirements for turboprop and turbojet aircraft have been proposed by the Civil Aeronautics Board. They would apply to the new turbine-powered transports now starting through the certification cycle as well as all future models.

Originally scheduled for consideration at the annual Airworthiness Review next month, the turbine requirements are now proposed as a Special Civil Air Regulation that would apply the latest rules for turbine aircraft to all U. S. and foreign jet transports the Civil Aeronautics Administration has been asked to certificate.

The proposed rules will be discussed at the September Airworthiness Review, but the CAB decided they needed faster treatment than the ordinary review process and issued a draft release this month. Comments on the proposal must be sent to the Board by Oct. 15.

Under present practice, a new aircraft is required to meet only the airworthiness requirements detailed in Part 4B of the Civil Air Regulations that are in force at the time application for certification is filed. Thus, a manufacturer who applied for certification a year ago would not have to meet requirements added in the past year.

The CAA has authority to impose special requirements in addition to Part 4B to maintain an equivalent level of safety on particular aircraft, but the CAB feels there is a need for a set of specific, uniform requirements.

The Board thinks that when the 1956 Airworthiness Review is completed, all major revisions of the Civil Air Regulations necessary to cover turbine powered aircraft will be complete. In the last two years, there have been substantial changes in the regulations to cover the jets.

The CAB decided to go ahead with the Special Civil Air Regulation for turbine aircraft in order to bring all turboprop and turbojet aircraft under a complete set of up-to-date performance rules specifically written for the new family of transports.

The CAB took a major step in revision of the regulation when it decided to include operating rules along with certification requirements in the proposal. The Board said "these two phases of any performance code are so interrelated that they cannot be treated separately."

While the CAA has authority to impose special conditions for certification under Part 4B, it does not have the same authority for operating conditions under Parts 40, 41 and 42. The CAB proposal would establish a concrete, coordinated set of regulations covering both operating and certification phases.

The special regulations will be discussed along with 17 other agenda items at the Airworthiness Review when it convenes in Washington on September 10. The CAB Bureau of Safety Regulation expects 15 to 20 foreign technical representatives to attend the 1956 meeting. Many of the foreign representatives will go on to the International Civil Aviation Organization conference which starts September 18 in Montreal and will deal with international airworthiness standards.

Most of the items on the agenda for the review are concerned with revising the regulations to meet new problems and conditions involved in turbine powered aircraft.

Curtis Names Group To Draft Airways Plan

Washington—A team of 11 scientists and engineers has been named by Edward Curtis, presidential assistant for aviation planning, to prepare a plan for a common airways system that will meet the future requirements of the aviation industry.

The program calls for development of aviation facilities that will phase in with the present airways system and also fit in with long-range requirements. The comprehensive plan, scheduled to be completed by January, will include recommendations for any equipment testing or development that may be necessary to implement the program.

Members of the group are:

- **Preston Bassett,** former president of Sperry Gyroscope Company.
- **Dr. Samuel Alexander,** chief of the Data Processing Systems Division of the National Bureau of Standards.
- **James Anast,** systems planning advisor to Curtis.
- **Gordon Dewey,** research analyst.
- **Dr. Ralph Johnson,** vice president of the Ramo-Wooldridge Corp.
- **Lloyd Perper,** consulting engineer.
- **Dr. Ralph Queal,** chief of the Crew and Systems Section, Psychology Branch, Aero Medical Laboratory, Wright Air Development Center.
- **Norman Smith,** traffic control operations consultant.
- **Martin Warskow,** supervisor, Airport Navigation Standards, Port of New York Authority.
- **Michael Witunski,** lecturer in aeronautical engineering at St. Louis University.
- **George Litchford,** project director of requirements study for Curtis.

Bendix PB-20 Systems To Control Boeing 707s

Bendix Aviation Corp.'s Eclipse-Pioneer Division has received a $2.5 million order for PB-20 automatic flight control systems for Boeing 707 jet transports.

Deliveries to Boeing are to begin next April. First systems will go into American Airlines and Trans World Airlines 707s. The PB-20, result of a 10-year development program, uses transistors and magnetic amplifiers and has no vacuum tubes. The entire system is designed on the building-block principle.

The PB-20 already has been specified for use in Lockheed 1649 Constellations and Electra turboprops, USAF's Douglas C-133A, and two Canadian military aircraft.

American's Stewardess School

Stewardess School planned for early construction by American Airlines is said by the carrier to be first of its kind in U. S. The $1 million, two-story building, to be located near Fort Worth, Tex., airport, will train 1,000 student stewardesses yearly.

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SAS Receives First DC-7C

Scandinavian Airlines System has received first of 14 DC-7Cs, and plans to put the Douglas airliner into transatlantic service Sept. 7 between New York and Copenhagen. Nonstop flight time eastbound will be scheduled at 11 hours, 45 min., westbound at 15 hours. Second SAS DC-7C will go into Los Angeles-Copenhagen transpolar service Oct. 7, with one-stop service each way. Feature of the SAS tourist cabin is staggered three-abreast seats to provide more passenger elbow room. Mixed flights will carry 44 tourist, 16 first-class passengers. Delivery flight of first SAS DC-7C made 4,043-mi. nonstop New York to Stockholm in 11 hours, 45 min. at 356 mph.

KLM Reorganizes Financial Structure

The Hague, Holland—KLM Royal Dutch Airlines has reorganized its company structure in a move to ease its entry into the capital market, the carrier has announced.

An extraordinary meeting of KLM's shareholders approved establishment of a new management group, a new shareholder-appointed board of directors, and abolition of a type of priority stock shares owned exclusively by the Dutch government. Remaining are one type of priority shares and one type of common stock, with the government holding a majority. KLM now is also permitted to buy its own shares.

Capital Reports Loss For First Six Months

Washington—Capital Airlines has reported a net loss of $1,609,000 for the first six months of 1956, compared to a net profit of $3,465,000 for the first half of 1955.

"Extraordinary costs involved in integrating Viscount fleet" accounted for $852,000 of the 1956 loss. Income for 1955 was bolstered by $5,375,000 from equipment sales. Same source has produced only $662,170 so far this year.

Although operating revenues for the six month period showed an increase from $22,039,000 in 1955 to $26,310,000 in 1956, operating expenses climbed from $24,153,000 to $29,145,000. The expense rise is attributed to additional personnel and facilities to handle increased Viscount service on the new route structure recently awarded by the Civil Aeronautics Board.

CAA Officials Study New British Transports

Washington—De Havilland Comet recently ordered by Capital Airlines and the Bristol Britannia now on tour in the U.S. will be studied this week by a Civil Aeronautics Administration type board meeting in England.

S. H. Rolle, CAA powerplant engineering chief, and A. A. Vollmecke, head of CAA's airframe engineering branch, arrived in England last week to join L. Morda, Region One engineer, and R. Maloy, foreign engine representative. The team will move to France the week of August 27, to set up a type board meeting on the Sncase Caravelle.

While in England, Maloy and Rolle will consider applications for U.S. certification of the Napier Eland, Bristol Proteus and the Rolls-Royce Conway, Avon, Tyne and advanced Dart engines. In France, applications for U.S. approval of the Marbore II, Artouste and Palouste engines will be studied.

The entire team also will study the Alouette and the Djinn helicopter, although no type board meeting will be arranged for the two Sncase aircraft. (Another Comet story is on p. 72.)

Lacsa May Purchase Convair-Eland 440s

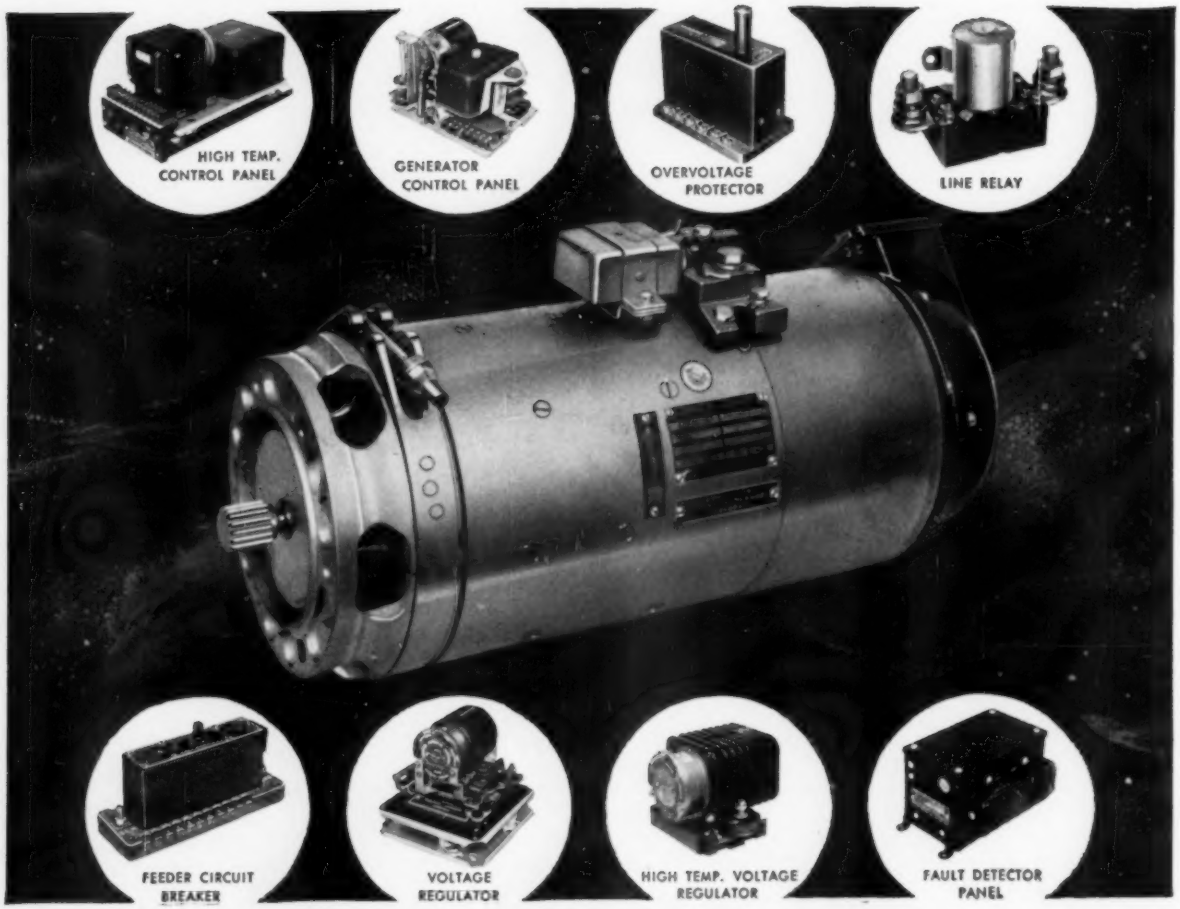
San Jose, Costa Rica—Costa Rica's national airline, Lacsa, is discussing the purchase of Convair 440s powered by Napier Eland turboprop engines.

Lacsa now uses Convair 340s on routes from Costa Rica to Miami, Fla., Panama, Puerto Rico, El Salvador and Mexico City.

Shortlines

► **Civil Aeronautics Administration** officials met with Boeing Airplane Co. engineers and test pilots in Seattle last week to discuss air traffic control and airport problems involved in jet transport operations. CAA group included representatives of the Offices of Planning, Research and Development, Air Traffic Control, Air Safety and Federal Airways and Airports.

► **Air Transport Assn.** reports that



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scheduled airlines flew 2,241,867,000 passenger-miles in May, a 12.2% increase over May, 1955. Scheduled airline passenger fatality rate for the year ending in July was .95 per 100 million passenger-miles. The rate was .10 for the international airlines; 1.15 for the domestic carriers.

▶ **Canadian Pacific Airlines** has signed a $376,000 contract for a new office building at Vancouver International Airport.

▶ **CINTA,** a Chilean airline, is inaugurating a Santiago-Miami passenger service this month with weekly flights using 38-passenger C-46 equipment.

▶ **Flying Tiger Line,** a new member of the Air Transport Assn., bought stock in Air Cargo, Inc. which is owned by several of the scheduled airlines. Air Cargo, Inc., began its first pickup and delivery service for Flying Tiger Line Aug. 1 in Detroit.

▶ **KLM Royal Dutch Airlines'** passenger sales in the United States for the first half of 1956 were 12.7% higher than sales in the same period last year. KLM freight business increased 27.6% in the same period.

▶ **Lines Aeree Italiane** has been granted a $6.2 million loan by the Export-Import Bank to finance purchase of Lockheed 1649 Constellation equipment.

▶ **Mohawk Airlines** carried 26,339 passengers in July, a 9.5% increase over the previous July. Traffic for the first seven months of the year totaled 192,951 passengers, 34.5% more than the airline carried during the same period last year.

▶ **Ozark Air Lines** leased three DC-3s from the Navy and will have Pan American World Airways modify them to the Hi-Per DC-3 configuration. When modifications are completed on all three planes in October, Ozark will then have a fleet of 20 DC-3s in scheduled service.

▶ **Swissair carried** 346,362 passengers during the first half of the year, a gain of 25% over the 1955 period. Load factor was 65.5% as compared with 61.1% for the first half of 1955.

▶ **United Air Lines** flew 429,539,000 passenger-miles in July, an increase of 11% over the previous July. . . . United has signed interline agreements with Gibraltar Airways, Braathens South American and Far East Airtransport, Union of Burma Airways and Cambrian Air Services.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

Control Communications

A question which has been asked repeatedly in recent weeks is, "What can be done right now about air traffic control?" A start is being made of course, on the long-range plan—but mostly people are interested in "this year improvements."

What happened the evening of July 20 in the Washington area is typical of problems where some immediate remedies can be applied. Mainly they concern communications—still the area of greatest need.

For reasons unknown at the time, the Washington Center was having extreme difficulty understanding pilot reports on 124.0 mcs. It was necessary for everyone in the air to repeat and repeat and repeat. And it was also necessary for aircraft close in to relay clearances to those further away since the center could not establish two-way communications at the fringe of the control zone.

Radar Went Out

Then a rainshower hit the area and, as always, the radar became inoperative. Approach times jumped to nearly two hours and a snarl ensued that bordered on comedy. Of course, it wasn't funny. There is no humor attached to holding inside a thunderstorm watching the fuel drain away.

A trip to the Washington Air Route Traffic Control Center after landing disclosed several interesting facts. The controller using 124.0 had a receiver which also was hooked up to 135.9 (the military en route frequency) in such a manner that the unwanted signals could not be cut out. The controller was forced to listen to two frequencies, one of which was producing "garbage" (the controller's own word) from hundreds of miles away. If ever there was a case for a handy man with a wire cutter this was it.

The only accident observed on this trip was the spilling of a bottle of coke over some sandwiches and posting strips. This occurred when a controller made a quick move to the adjacent position and upset his dinner. Since the Washington Center is 11 men short, this crew had been on duty continuously since 4 p.m. (it was then 9 p.m.) with no relief and therefore it was necessary to gobble "dinner" a bite at a time between radio transmissions.

Enough Receivers

So here are some things that can be done now for traffic control. Without minimizing the need for continued progress towards automatic message transmission it is still a fact that we will have to work with present manual posting and hand microphone techniques for some time. This being so it is obvious that there must be enough radio receivers to go around—one for each frequency—and the equipment, including antennas etc., must be "hi-fi" and capable of coverage to the extreme of the controllers zone. Obviously "rainproof" radar would also help.

More than anything else, we need experienced men to operate this system. As previously reported in this column, controllers have been leaving their jobs in droves lately. CAA has been trying to remedy this for several years via more pay and upgrading. Recently, however, the Civil Service Commission submitted criteria which would downgrade many controllers and which may cause additional manpower loss in these vital posts.

Items like these could be corrected in jig time. They are not spectacular cure-alls, but they are typical of the small ills that plague our present system. A team of traveling trouble shooters, armed with money and authority, could no doubt find many more correctable items. And such improvements might help tide us over until the days of "The Plan."

AIRLINE OBSERVER

► Air Transport Association has reached a definite decision on a collision warning device after a three day meeting with manufacturers. Of 20 proposals made, the special ATA committee found that 10 showed a thorough understanding of the problems involved. The design selected will be submitted to airline managements for further review before a final decision is made.

► Pan American-Grace Airways will install a new Synchophaser propeller synchronizer on a DC-7B for tests on regular service between New York and Buenos Aires. Manufactured by Hamilton Standard Division of United Aircraft Corp., the Synchrophaser is said to reduce noise to the equivalent of 800 lb. of additional sound-proofing.

► American Airlines will install reflecting lights on wing tips of its Lockheed Electras as a ground anti-collision device. Capt. John Harris won $500 for the idea under the airline's new employe suggestion program.

► If international air traffic continues to grow at last year's pace, ton-miles handled by international carriers in 1959 will be double that of 1955. If the average rate of increase during the past four years is maintained, traffic will have doubled by 1960.

► British Government has formally asked to open negotiations with the Soviet Union for direct air service between London and Moscow but has had no response from Kremlin leaders. Britain has long favored direct service between the two capitals and hopes to get an invitation similar to that offered Pan American World Airways. Meanwhile, British European Airways wants an air link with Aeroflot at Berlin. Discussions between the two governments last November led nowhere due to the British foreign Office refusal to carry on negotiations with the Communist East German Administration.

► Capital Airlines is installing a new type fuel dump chute on its Viscounts. The jettison pipe, produced by Vickers-Armstrongs, Inc., is not retractable and is mounted on the trailing edge of each wing. Chutes will increase maximum landing weights for longer hauls, are favored by Capital for safety reasons and simplicity of operation.

► Australians have abandoned hope of an extension of Qantas Empire Airways' routes beyond San Francisco to New York and London to complete an around-the-world service. Observers in Australia believe the extension has been refused because permission has never been granted to Pan American for a route between Australia and New Zealand.

► Japanese government, which recently announced plans to build two twin-engine turboprop transports, expects the first one to be completed by the end of 1961. Design and experimentation is scheduled for 1957-58.

► Air travelers behind the Iron Curtain now get three times as many Czechoslovak crowns for dollars as they did under old rates of exchange. This is the first admission by a Soviet-bloc nation that its currency is pegged at an unrealistically high rate in relation to the dollar. Official dollar exchange rate for Russian ruble is four to one. For some commercial uses, a rate of eight to one is available but a more realistic exchange rate would be 10 to one.

► Hydrant fueling for helicopters using the mid-Manhattan heliport now under construction will be provided by an underground system being installed by Shell Oil Company at the 30th Street site. Shell will sell aviation fuel at the heliport on a non-exclusive basis under a five-year agreement with the Port of New York Authority. New York's newest airport facility will be first in the area with the hydrant system. 8,800-gallon storage capacity, however, is much smaller than the fuel farms at the other airports—the 4,880,000-gallon facility at New York International, for example.

Surface Mail Rates Established by CAB

Washington—Final rates for hauling surface mail by air were set last week by the Civil Aeronautics Board at the temporary rate levels which the Post Office Department has been using for almost three years.

CAB decided the airlines should be paid for carrying first class and other preferential mail at these rates:

- **Rate of 18.66 cents** a ton-mile between New York/Newark and Chicago, Jacksonville, Tampa and Miami, effective Oct. 1, 1955.
- **Rate of 20.04 cents** a ton-mile between Chicago and Washington, Jacksonville, Tampa and Miami and between Washington and Jacksonville, Tampa and Miami, effective Oct. 1, 1955.
- **Rate of 18.98 cents** a ton-mile between Seattle, Portland, Salem, Bend, Redmond, Eugene, Medford, Klamath Falls, San Francisco, Oakland, Sacramento, Stockton, Modesto, Merced, Salinas, Fresno, Visalia, Bakersfield, Los Angeles, Long Beach and San Diego, effective Nov. 22, 1954.

These are the rates under which the Post Office has paid the airlines since the surface mail experiment started on Chicago-New York and Washington-Chicago routes in October, 1953. Since then, the experiment has been expanded to Florida and the West Coast. Coast.

The rates apply to American Airlines, Capital Airlines, Flying Tiger Line, National Airlines, Slick Airways, Trans World Airlines, Delta Air Lines, Eastern Air Lines, Northwest Airlines, Riddle Airlines, United Air Lines and Western Air Lines.

In its decision, the CAB said surface mail is a profitable form of traffic to the airlines since it is carried on a space-available basis. The Board rejected arguments that the service should pay a full share of allocated costs and said the rates should only have to cover additional costs involved.

Lufthansa Specifies Conways

London—Rolls-Royce reports Lufthansa has specified Conway bypass engines for four Boeing 707s which it has on order. This is second order for Conways on American airframes.

Trans Canada ordered four Douglas DC-8s with Conways. In addition, BOAC has specified Conways for Boeings which it is seeking government permission to order.

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Russian Engineering Education, Part 1:

Soviets Pick the Electives, then the Job

By Leon Trilling

In the United States and in most Western countries, a man trained as an electrical engineer has a wide range of employment possibilities. He may, for instance, seek a job with a firm manufacturing electric appliances, or with a telephone company improving the efficiency of communication networks, or with an aircraft builder designing automatic control or radio equipment.

The range of his special skills in the field of electrical engineering should enable him to handle any of these positions after a brief training period on the job, and he will have sufficient general engineering background to orient himself.

Horizontal approach to engineering education is the only possible one when educational institutions are independent from productive facilities. It stresses versatility and fundamentals. It allows great flexibility in the distribution of engineers. It leaves the last, most specialized portion of the engineer's training to his employer, to whom this is satisfactory since many trade secrets and much proprietary information is best kept restricted to as few people as possible.

The situation is altogether different in the Soviet Union. Responsibility for the productive activity of the nation is divided among a small number of powerful ministries, each of which has full charge of a definite segment of the industrial economy: the Ministry of Heavy Machinery Construction builds steel plants, large installations, and the basic productive equipment facilities; the Ministry of Light Machinery produces automobiles, trucks, medium machine tools; and so on.

Each ministry is responsible for many services and much auxiliary equipment needed in its main task: housing in newly developed areas, factory construction, light and specialized tooling, control equipment, safety equipment.

The economy is organized largely by vertical integration and each ministry strives for a very high degree of autarchy. In particular, each ministry trains in its own institutes the skilled personnel—engineers, economists, and others—necessary for its operations. (An administrative connection between ministry and engineering institute was severed by the 1946 decree on higher education. Since neither teaching personnel nor curricula were appreciably modified, the practical effect is not likely to be great for some time.)

At the Bauman Institute the Ministry of Heavy Machinery trains not only mechanical engineers but also chemical, electrical, and civil engineers, and even economists and personnel managers. At the Moscow Oil Technology Institute the Oil Production Ministry trains not only chemical engineers but also mechanical and other engineers required to design and produce drilling machinery, control and valve equipment.

A mechanical engineer of the heavy industry ministry may be trained to design the same valves and piping as his colleague of the Oil Production Ministry without any interchange ever being contemplated.

Particular Field

In view of the utilitarian bias of Soviet education and the predominant place of the natural sciences and engineering, it appeared desirable to examine the training and background of a group designing and constructing a particular industrial product—an aircraft—to judge the system on its own merits and to evaluate how effectively it fulfills its stated purpose.

Active fundamental research is essential to planning of an aircraft; its design and construction require great engineering skill; its successful production is considered essential by the Soviet leadership.

Though close connection with military buildup makes detailed information difficult to collect, aeronautical engineering is a clearly defined field convenient for a "case study"—and it happens to be the field of technical activity of the writer.

Before an aircraft designed to the specifications of air force generals or airline executives completes its first successful flight, the aeronautical industry goes through a complex process of fundamental and applied research, development and testing, design and finally production.

Competence and creative activity in a number of basic sciences form an indispensable background. Mathematics and fluid mechanics are needed to determine the flow of air around the airplane. Solid mechanics to predict the elastic and plastic properties of the airframe under stress and at high temperatures. Physics and electronics underlie the principles of modern instrumentation and automatic control. Chemistry dictates fuel selection. Biology and physiology predict pilot reactions under extreme maneuvers.

The research scientists thus performs an indispensable preliminary task and offers valuable help to the designer.

His results are applied to aeronau-

ONE OF THREE Sukhoi experimental delta fighter models that flew at Tushino air show. This model shows radome nose, chin air intake which may be bifurcated and 30 mm. cannon gunport just forward of leading edge of delta wing. Note thin delta wing and low set horizontal tail.

YAKOVLEV Super-Flashlight all-weather fighter shows pointed radome, slim engine nacelles, two wing fences outboard of engine nacelle and constant chord of swept wing. Note ventral fin just below tail and tandem cockpit accommodating pilot, radar operator.

tical problems by "applied scientists" or "development engineers." These men apply the laws of fluid motion to calculate the temperature distribution and the lift and drag forces on an airplane wing, or theory of elasticity to study the stressed skin and thin shell structures basic to airframes, or experimental techniques to test the configurations common to most aircraft. In short, this group must understand the results of fundamental research and make them conveniently available to the designer.

Turned Into Blueprint

When the fundamental scientist and the applied scientist have done their work, the design team uses their results to prepare a blueprint which balances all the requirements of the customer and takes due account of what the available productive machinery can turn out.

In its operation the design team is usually broken down into several groups; a preliminary (or general) design group which decides on the broad outlines and characteristics of the planned aircraft and carries the major responsibility for its performance; a series of sections which specializes on definite parts (wing group, fuselage group, landing gear and hydraulic system group, powerplant group, etc.); service groups which give expert advice or guidance on special problems (aerodynamics group, electronics and systems group, etc.); and groups responsible for every type of testing (in the wind tunnel in flight, structural and fatigue testing, engine testing, etc.).

When the details of the design are completed the blueprints are translated into the finished product on a production assembly line, under the supervision of engineers who must be familiar with aircraft problems but whose main skills lie in the fields of production scheduling, machine tool design and operation, manpower management, economics, and so on.

It is as a direct result of their efforts that the actual airplanes roll off the assembly line.

The task of making an airplane is thus broken down into four main activities: research, development, design, and production. No definite boundaries exist. Nevertheless, this division of the task is convenient since the people mainly engaged in each activity require definite skills and attitudes which they acquire from different training grounds.

The degree to which there is intercourse between the various activities in the form of recommendations for improvements or suggestions for meaning-

Background: Author and Study

"Soviet Education in Aeronautics: A Case Study" by Leon Trilling is a part of an examination of Soviet education in science and technology undertaken by the Center for International Studies, Massachusetts Institute of Technology under a grant from the Carnegie Corporation of New York. (Soviet Education in Science and Technology, An Examination of Some of the Qualitative Factors, Volume Two, Soviet Education in Aeronautics: A Case Study, by L. Trilling, Copyright, 1956, by the Massachusetts Institute of Technology.)

A report on the general findings of this research, tentatively entitled Soviet Education in Science and Technology, is scheduled for publication early in 1957.

Dr. Trilling is assistant professor of aeronautical engineering at MIT. Born in Poland of Russian-speaking parents, Dr. Trilling received his secondary school education in France. After emigrating to the United States in 1940, he entered the California Institute of Technology where he received the degrees of bachelor of science (1944), master of science (1946), aeronautical engineer (1947), and doctor of philosophy (1948).

Dr. Trilling was a Fulbright Fellow in France in 1950. He was appointed a research associate at MIT in 1951 and has been assistant professor of aeronautical engineering at MIT since 1954. Professor Trilling's chief fields of study and interest are aerodynamics and fluid mechanics.

full new research problems is a measure of the health of the industry.

In general, the Russian research scientist receives his education at a university and carries on his work in various institutes of the Academy of Sciences.

The development engineer may be an alumnus of a polytechnic institute, an aeronautical institute, or a military air academy; his work is done at an academy institute or at one of the large reserch institutes sponsored by the aviation ministries.

Several leading designers appear to be graduates of the Zhukovskii Military Air Academy, but the average engineer is trained at an aeronautical institute. Designing is apparently done at design bureaus, and the testing at TsAGI (Central Aero- and Hydrodynamic Institute near Moscow).

The production engineer, usually a product of the aeronautical or air technology institutes, operates at the factory.

First the undergraduate training of engineers will be discussed generally and that of aeronautical engineers in particular, then graduate training and research in aeronautics, and finally the contributions of research in basic science to the development of aeronautics in the Soviet Union and the integration of the various parts of the aeronautical complex under the ministries responsible for its functioning, mainly the Ministry of Aircraft Production.

HIGHER EDUCATION

Among the 791 institutions of higher learning in the Soviet Union there are 33 universities; 302 institutes devoted to training elementary and secondary school teachers, librarians, etc., and 456 institutes of various sorts devoted to professional training, 296 of the last (65%) devoted to engineering.

Of 128 major subjects in which Moscow University offers a degree, 95 (74%) are in the natural sciences and engineering; at Leningrad University, the proportion is 68 (73%) out of 93.

Even in the absence of accurate statistics on the distribution of the student population, these figures indicate the predominant place of the natural sciences and engineering in the Soviet educational scheme.

In contrast to the American system of a multitude of independent privately endowed and controlled universities and institutes supplemented by a smaller number of state universities, the administration of the Soviet system is highly centralized. Most institutions of higher learning were controlled by the central authority before the Revolution. The Soviet administration has preserved this arrangement, with the USSR Ministry of Higher Education exercising exclusive academic control over the entire system of higher schools and directly administering the majority.

Academic control includes setting and enforcing standards of admission and teaching, establishing programs and curricula, selecting textbooks, granting degrees, passing on the qualifications of the faculty.

Administrative Role

Prior to 1946 only the universities and the polytechnic institutes were administered directly by the Ministry of Education; the technical institutes were attached to the industrial ministries, for which they trained specialists.

Under the 1946 administrative reorganization the major engineering institutes (mechanical, aeronautical, power, electrical) were placed under the Ministry of Higher Education. This reform, aimed at broadening education and promoting interchange of ideas and information between various fields, does not yet appear to have had any noticeable effect. The aeronautical institutes are still largely staffed by part-time employes of the Aviation Ministry and the Zhukovskii Military Air Academy by those of the Ministry of Defense.

For purposes of academic administration the university or institute is divided by subjects into departments

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(fakultety), each of which is divided into chairs *(kafedry)* supervised by senior professors.

Mathematics department, for instance, may have chairs in mechanics, differential equations, algebra. Each chair, especially in the larger universities, includes several courses, each headed by its professor. Mechanics chair might include professorships in fluid mechanics, elasticity, rigid body dynamics, etc.

Below the rank of professor on the Academic ladder is the docent, equivalent to associate professor or assistant professor. A docent may head a course or even a chair or a new or relatively unimportant department, especially in some of the smaller universities or institutes. Then follow the senior assistant (equivalent to an instructor) and the assistant (graduate teaching fellow), who may teach sections of a course outlined by a senior staff member, or conduct problems and laboratory sessions. (In the larger universities even the recitation periods are in the charge of docents.)

Communist Courses

With a few exceptions, the regular undergraduate course of a university or institute lasts five to six years during which the students devote 10% of their time to lectures on Marxism-Lenism, history of the Communist party, dialectrical materialism, and related indoctrination subjects. The rest is a technical curriculum which starts on a broad basis and gradually becomes specialized.

To get credit for a course students must pass an examination given by the chair in charge. To graduate and receive their diplomas, they must pass a number of oral and written examinations and defend a thesis before an examining committee selected and sent over by the Ministry of Higher Education. The emphasis on individual work and the requirement that a thesis be defended for the granting of a bachelor's degree antedates the Revolution (see biography of V. V. Golubev in *IZV. Ak. Nauk [Otd. Tekh. Nauk]*, 1954, Vol. 12). But the projects required of bachelor candidates do not always break new ground (Rottgardt).

Having obtained his diploma, the student must be fitted into the fabric of productive society. In the United States this is done by a rather haphazard but effectively flexible process in which prospective employes and employers strike individual bargains in the open market, the law of supply and demand left to adjust the distribution of graduating technicians through pay-scale differences.

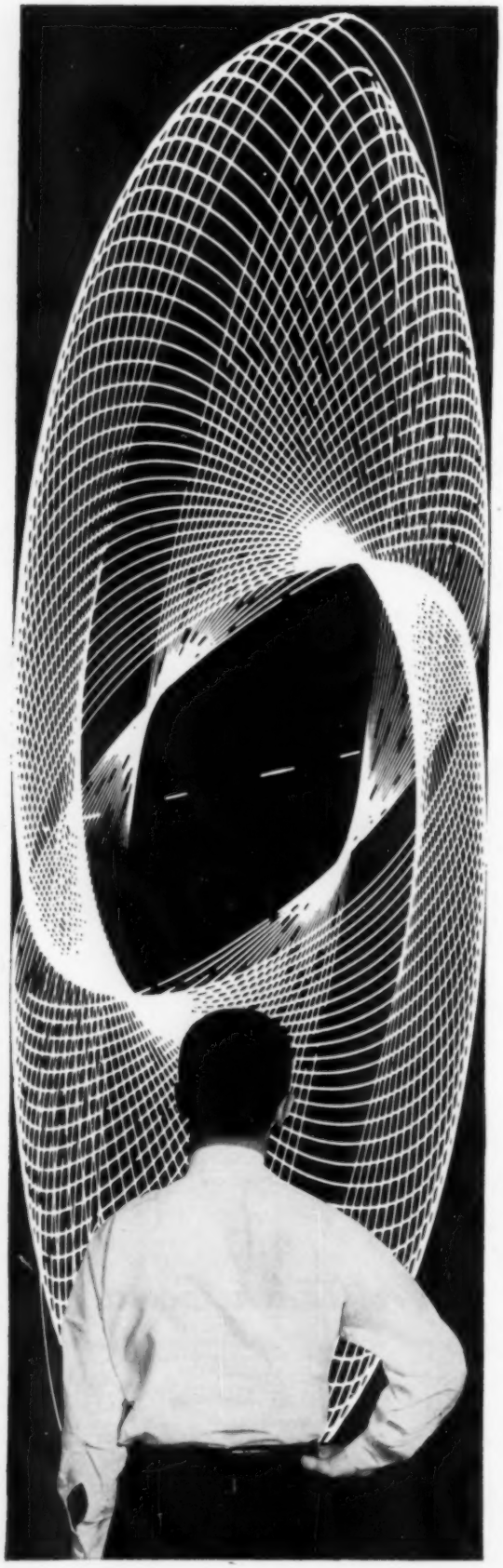
American education is broad enough to allow this process to operate effectively. In the United States in 1940-1942 the aeronautical industry expanded very rapidly by absorbing mechanical and civil engineers, physicists, mathematicians, and other personnel, and even today an aircraft company may put a former civil engineer in charge of a structures group (as Lockheed has), or a physicist as deputy chief of flight testing. Flexibility helps allow segments of the economy to expand and contract rather rapidly as circumstances require.

In the Soviet Union the problem is mainly to assign individual students to individual openings, and this is done somewhat differently in the universities and the specialized technical institutes.

University (and to a lesser extent polytechnic institute) students are destined to careers in teaching and research.

Those who show exceptional promise are recommended by the professor in charge of their chair and approved by the examining commission for immediate entry to graduate school. Their number is small, on the average under 2% of the graduating class. Others are assigned to teach at pedagogic institutes (normal schools) and secondary (high) schools or to do research at distant field stations for a stage of seasoning.

Assignments take into account personal factors, but the main considera-



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tion of the Ministry of Higher Education and the "Cadre Commission" of the Communist party without overt consultation with the individual (though personal connections may play a role in reality). It is considered normal to send individuals to sections of the USSR distant from their homes for this period of seasoning.

Once assigned to a position, nominally for three years, the young engineer or scientist finds himself under strong pressures to remain for much longer periods of time. He cannot leave without losing his seniority, accumulated social security, and medical insurance benefits, unless he manages to be transferred to a new position. He receives promotions and raises much more rapidly if he stays put.

Most university students wind up teaching in high school. Some draw research institutes and a few graduate school.

Even fewer graduates from specialized technical institutes get into the research apparatus. Almost all are assigned to medical, agricultural, engineering, or other jobs in the field. Job assignments are handled by the personnel section of their ministry and the representatives of the facilities where new personnel is required, but without consulting the individual concerned. Some weight is given to his tastes and personal circumstances, but the ministry's requirement is the main consideration.

(The Soviet job assignment process appears similar to the station assignment process for graduating young officers from military schools [West Point or Annapolis]. Since the engineering institutes are federally operated to supply the Soviet administration with skilled personnel just as West Point is operated to supply the U. S. Army with officers, this is an administratively natural procedure.

(An even closer analogy may be made with the Ecole Polytechnique, which, being a creation of the French Revolution, was a model closely studied in the USSR. The Ecole Polytechnique supplies the French Army and civil service with young engineers, and every graduating class has a number of vacant positions to fill.

(But the distribution of graduates among available jobs is done as follows: the student with highest record has his choice of all available jobs; the next best student has his choice of what remains and so forth, so that there is a good deal of freedom left to the individual in spite of the centralized organization. This is not the case in the USSR, at least on the face of it.

(In fact, something like it may well be going on informally, though the geographic dispersion and number of people involved makes any formal individual polling of desires impractical. As long as a shortage of technical personnel exists, the students are in a good position to make preliminary personal inquiries and contacts which come to the same result in the end.)

Although this is the standard procedure of job assignment according to the official literature, three Soviet witnesses interviewed suggest the existence of much more arbitrary procedures, as the so-called "party mobilization" — the process by which the Communist party selects among the senior members of the student population a group considered unusually able and aggressively loyal to the regime.

They are assigned to various academics (postgraduate schools) and trained for positions of leadership in the civil and military branches of the government.

The number affected by this procedure is small, but important because of eventual influence. In particular, this is how students are recruited for the Zhukovskii Military Air Academy for training that enables them to become top designers of military aircraft in the Soviet Union.

Principal feature of the Soviet job assignment process, based on the principle that higher education trains skilled technical personnel for service of the state, is deliberate disregard of individual wishes. Constant subordination of the individual to the national plan is an important psychological influence on professional people in the Soviet Union.

POLYTECHNIC INSTITUTES

There are in the Soviet Union twenty-five polytechnic institutes with a total enrollment of approximately 120,000 students. With the aeronautical institutes, they provide the main body of engineers and specialists for the aircraft industry.

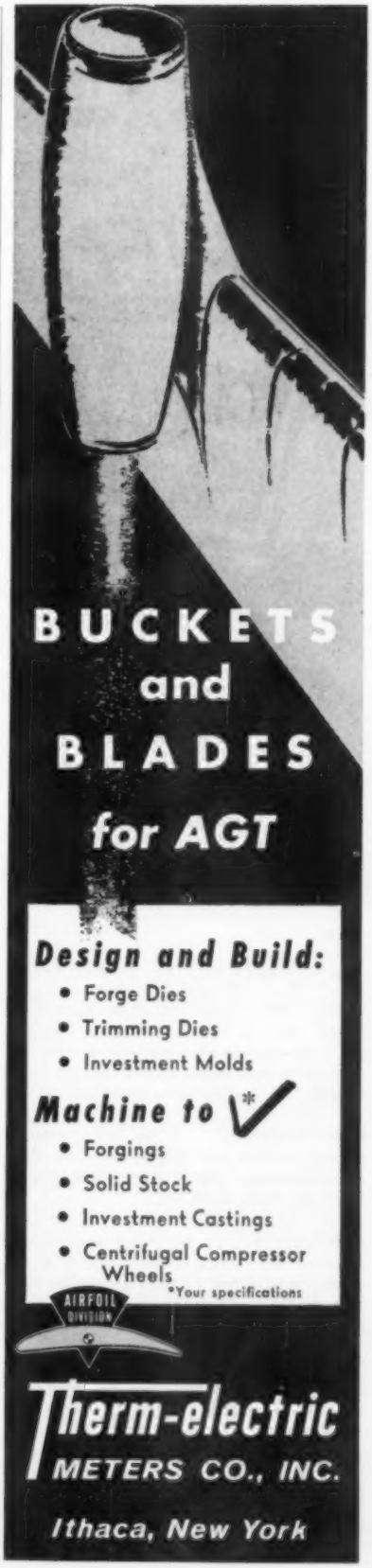
Nine of these institutes are located in the European part of the Russian USSR, three in Moscow and three in Leningrad; five in the Ukraine; four in the Caucasus area (Georgia, Azerbaidzhan, Armenia); four in Asia (two in Central Siberia, one in the Far East, and one in Turkestan), and one each in White Russia, the Western Ukraine, and Estonia.

One in Moscow and one in Leningrad are devoted exclusively to correspondence courses.

In purpose and scope the polytechnic institutes resemble American institutes of technology, as the Massachusetts Institute of Technology, or German-type *Technische Hochschules*. They train young men in the fields of applied science and engineering, the emphasis more on the engineering approach than on detailed information.

Fields of study for polytechnic institutes in view of their broad approach include those not readily assigned to any specific production ministry.

Among the problems of interest to aeronautical engineers, one finds research in turbo-machinery and heat transfer, which is essential not only to the design of jet engines but also to



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steam turbines, compressors, water turbines, power plants, and many other devices. One finds the development of precision laboratory and testing equipment: optical instruments essential to high speed flow measurements and to photography, physics, and many other fields; pressure measuring devices, balances, etc.

Polytechnic institutes generally do not have separate science faculties, but this does not mean that they do not teach the basic sciences.

Well-known mathematicians and physicists are often attached to the staffs of polytechnic institutes, supervise graduate thesis students, and direct laboratories. But these are special cases where research is often of an applied character and fits in one or another of the programs suggested by or assigned to the institute.

Administrative Groups

It is important to realize here that faculties are administrative groupings of students trained for a given skill rather than teaching staff groupings. The absence of science faculties merely indicates that engineering students do not major in pure science.

Since graduate students are assigned personally to given professors, there may be graduate students (*aspiranty*) on the basic sciences at engineering schools. Out of a total of 250, there were two *aspiranty* in mathematics at the Bauman Technical School (Moscow) in 1955 under Professor Staniukovich, or about half the mean load of a Bauman professor.

Evidence suggests that students primarily interested in science do not attend polytechnic institutes; they try to go to universities.

A physics department or a chemistry department with men of Nobel Laureate caliber on the staff, as the California Institute of Technology, or a mathematics department with a scientist like the Massachusetts Institute of Technology's Norbert Wiener, are not found at a Soviet polytechnic institute. Pure sciences are taught primarily as service courses during the earlier years of the curriculum, and occasionally as an advanced course when essential to a major field of interest.

Information obtained from various sources indicates that during the first of the five and a half years of almost any standard engineering program (mechanical, power, electrical, arconautical) the students take intensive courses in physics, chemistry, and mathematics, which are the same for all specialties, and a course in mechanics of materials which varies with the special field.

Since each of the technical courses involves three to four lecture hours per week and as many recitation and laboratory hours, and the compulsory indoctrination courses, dialectic materialism and the history of the Communist party) take six hours per week, the formal prescribed work load of the first year student is heavy indeed. He comes through with at least a solid formal foundation for most engineering work.

In the second year half the time is still devoted to basic science courses and the other half to general engineering subjects (physics of metals, general properties of engineering materials, etc.) which are common to most engineering faculties.

Specialization starts in earnest in the third year. The student takes some survey courses from several departments, but he spends at least half and later on an ever greater proportion of his time in his own department, absorbing more and more detailed information, and, after his third year, beginning to prepare an independent piece of work as a diploma thesis.

This last part of his education may be a part of the general research program conducted by the student's chair. It may be an investigation of a practical problem encountered while working during vacation. Especially in the larger departments, it often may be an extensive survey or an extended term paper without great originality.

There is little direct relationship between the polytechnic institutes and the aeronautical industry.

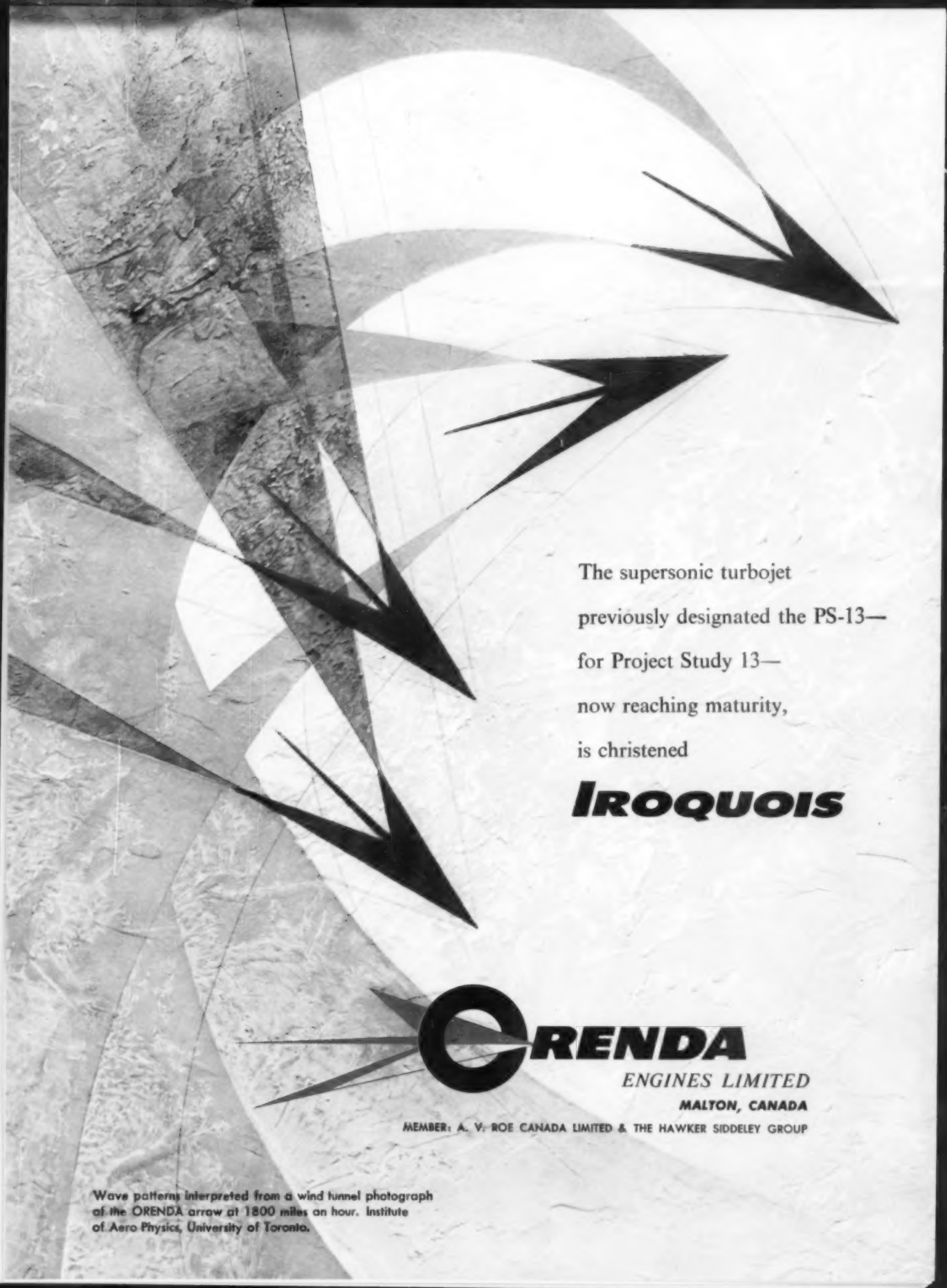
A relatively small number of engineers from the turbine and power plant departments of the Kuibyshev, Leningrad, Tomsk, and Kharkov Institutes may help build aircraft engines. Graduates from the Ural Polytechnic Institute (Sverdlovsk) may contribute to the design and operation of heavy machine tools. But the main contribution of the polytechnic institutes, like that of the universities, is in research and development.

AERONAUTICAL INSTITUTES

Preceding sections have dealt with training of the specialized personnel on the fringes of the aeronautical industry who supply it with scientific background information and channel its efforts to serve the needs of the state and, primarily, the Red Air Force. Now the education of the engineers who perform the actual tasks of designing, testing, and building airplanes will be described. They constitute the great bulk of the technicians examined in this study.

(Since it is well known that many graduates of polytechnic institutes and some of the less able university science graduates find employment in production ministries, the question may be raised whether the engineers employed by the aircraft industry are primarily graduates of aeronautical institutes.

(In its early days the industry undoubtedly recruited its technical personnel



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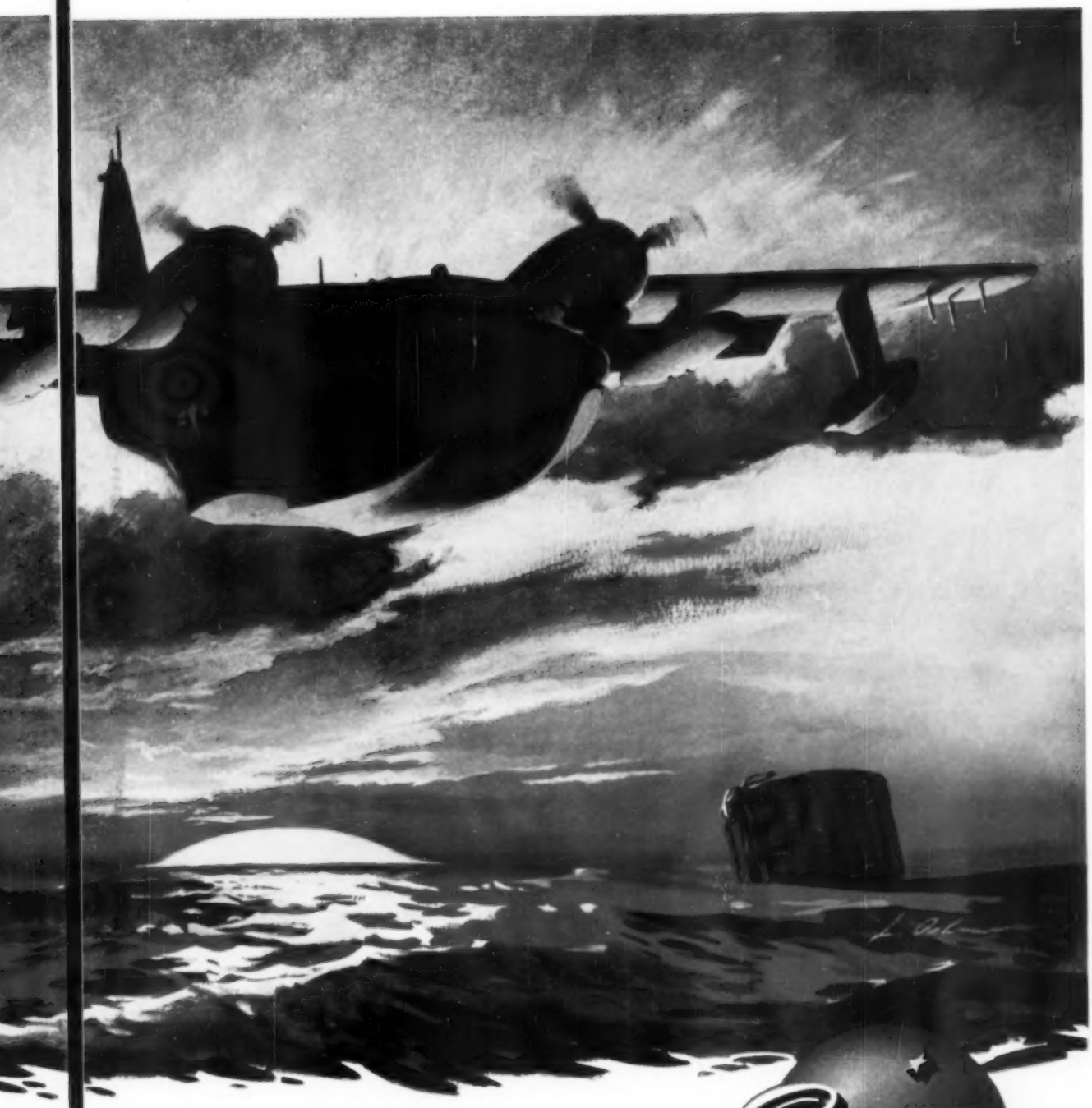

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where it could. Now, because of the special care it has received and because of the security veil which shrouds most of its activity, it is relying more and more on its own resources to recruit its staff.

(This writer was told by reliable witnesses that almost all design engineers, except in some new applications such as electronic year, and more than half the production engineers are now selected from among graduates of air institutes.)

On the basis of teaching staff ability and laboratory equipment, Ordzhonikidze Aeronautical Institute of Moscow is by far the leading institute. It trains graduate students in 32 different narrowly defined subjects that cover the whole range of activities of the aeronautical industry.

Moscow Air Technology Institute offers only 11 specialties, stressing production problems, and the Leningrad Institute 9 specialties, stressing electronics and automatic control. The Kazan Institute has 10 specialties, Kharkov six, and Kuibyshev one (1948).

The seven aeronautical institutes have a total enrollment of 20,000 students. Estimated on the basis of available figures for the number of staff members:

- **Ordzhonikidze Moscow** Aeronautical Institute has 6500 students.
- **Moscow Air Technology** Institute has 3000.
- **Leningrad Air Equipment** Institute, 2500.
- **Kazan** Institute, 2500.
- **Kharkov** Institute, 2500.
- **Kuibyshev** Institute, 2000.
- **Ufa** Institute, about 1000.

Total figure of 19,000 to 20,000 may be compared to about 6,600 aeronautical engineering students in the United States in 1954—noting, however, that the field covered by students of Soviet air institutes is a good deal broader than that covered by students in the United States.

If one is to consider only aircraft design students the Soviet figure is approximately 9,000 students as against 5,000 in the United States.

It is notable that 47% of Soviet students are concentrated in Moscow and that Soviet aeronautical teaching is concentrated in seven large institutions located near airframe plants (Moscow, Kuibyshev, Kazan, Kharkov), engine plants (Moscow, Kuibyshev, Kharkov, Ufa), or electronics and instrumentation centers (Moscow, Leningrad). Aeronautical students in the United States are scattered in 71 small departments, the largest 13 of which have an enrollment of 200 to 350 each and are not necessarily located near major centers of aircraft construction.

Most Soviet students are regularly in residence. Some institutes (for example, both institutes in Moscow) have correspondence and evening course sections open to qualified nonresident students who must attend a concentrated series of lectures during their vacations and prepare extensive term papers during the year. Such students may fulfill the course requirements in six and a half years.

Since the regular course lasts five and a half years, one may expect a yearly graduating class of 2,500 to 3,000 (among them, 1,100 to 1,200 in aircraft design). Aeronautical engineering departments in the United States graduate approximately 900 bachelors and masters and 40 doctors every year.

The nature of the training given to Soviet aeronautical engineering students can be inferred from the list of faculties of the Ordzhonikidze Institute and of the Air Technology Institute in Moscow.

These are given in "Spravochnik" for 1950. The 1954 issue does not list faculties of aeronautical institutes although it does list those of other institutes.

It is not believed that the structure of aeronautical teaching has changed significantly since 1950.

Ordzhonikidze Moscow Air Institute, where the course takes five and a half years to complete (except the economics option which takes four and a half years), has undergraduate course options in:

- **Aircraft Design** and Construction
- **Engine Design** and Construction
- **Aircraft** Electrical Equipment
- **Radio Technology** Applied to Aircraft
- **Aircraft Instruments**, Armament, and Auxiliary Equipment
- **Engineering Economics** of the Air Industry

Air Technology Institute offers two principal undergraduate options which are divided into several specific fields.

- Technology: metal working and heat treating; welding; casting; dye-casting.
- Mechanics: aircraft structures; technology of machine design; aircraft instrument design.

Detailed breakdown of the specialties in which Soviet aeronautical engineers are trained clearly indicates the vertical integration of the air ministry.

Not only are aircraft design and the related fields of aircraft structures and control equipment taught; there are major departments to prepare designers of aircraft engines, auxiliary equipment, and armaments, and a special option for economists of the aircraft industry.

At the Air Technology Institute and in the graduate school of the Ordzhonikidze Institute, there is also a series of detailed courses to cover the techniques of production and plant management.

The ministry seems to need little help from other sources to staff either its technical or its planning, administrative, and production branch.

Provincial institutes are neither as large nor as thorough as the Moscow

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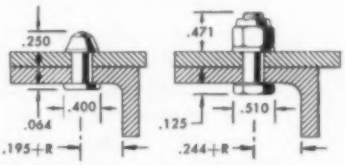

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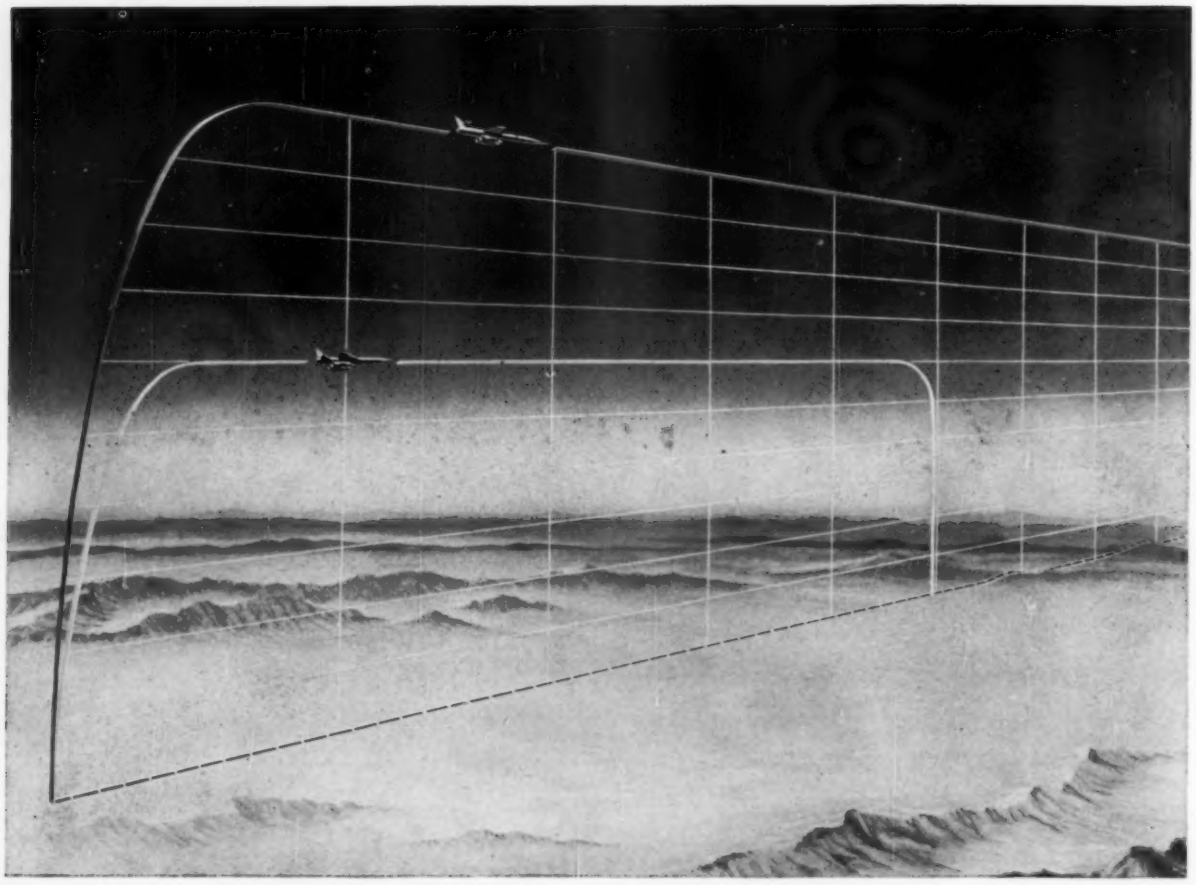

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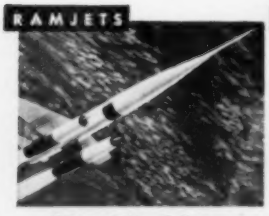

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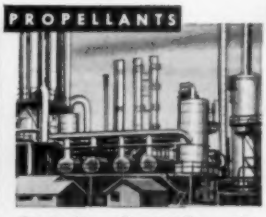

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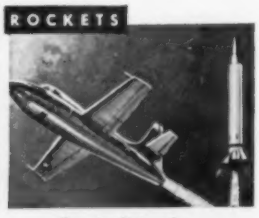

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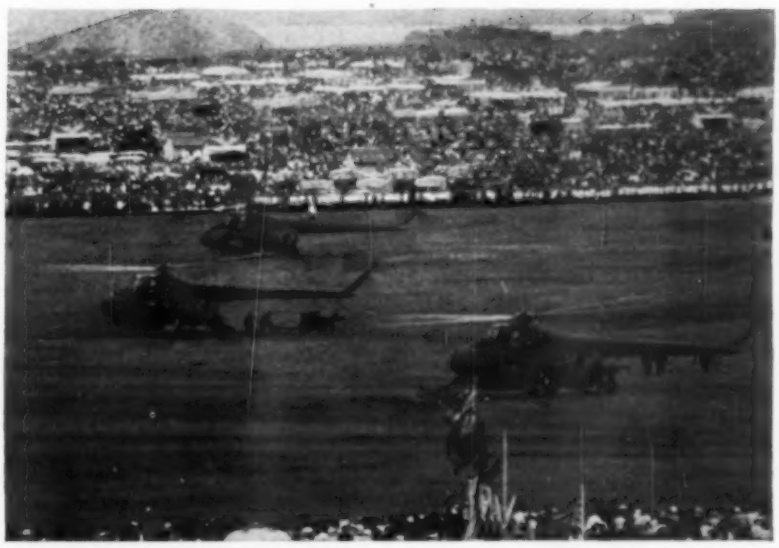

RUSSIAN HOUND helicopters, disgorging troops, are larger than Sikorsky S-55 and resemble S-58. Troops are leaving air evacuation pod beneath the main cabin.

institutes. Leningrad Institute appears to specialize in equipment, particularly electronic equipment for automatic guidance and control. Kuibyshev has faculties of airplane design and engine construction. Kharkov stresses theoretical aerodynamics (in cooperation with the hydraulics faculty of the Polytechnic Institute). Kazan has a well-rounded institute, and Ufa a small institute particularly active in engine design.

Thus there is a measure of correlation between the major activities of the smaller aeronautical institutes and the major local productive facility of the Aircraft Production Ministry.

An attempt has been made to estimate the relative importance of the various fields of study within the aeronautical engineering profession on the basis of the number of published textbooks known to be at the Library of Congress. Although this is not a wholly satisfactory method because the available statistical sample is not large enough, the results appear reasonable:

Airplane construction and design	44%
(a) applied aerodynamics (stability and control, performance, flight testing)	26%
(b) structural analysis, layout, and design	18%
Aircraft engine (both reciprocating and turbojet)	22%
Accessories, instrumentation, guidance and control	18%
Production techniques and properties of materials	13%
Economics of the air transport industry	3%

This distribution is quite different from the skill distribution of the graduates of a typical American department of aeronautical engineering, which would have 70 to 75% of the class specializing in design, 10 to 15% in engines, as many in guidance techniques and accessories, and a scattering in production techniques and economics.

Soviet distribution is much nearer the one we would expect to find in a large production aircraft company—although in the United States and Britain it is customary to purchase engines and accessories from special companies where they are designed by specialists not usually trained in the aeronautical field, the engine and accessory engineers employed by the aircraft producers being responsible for integrating these components into the airplane design.

Because the increase in flight speeds makes accurate control of aircraft increasingly difficult, there is a growing trend even in the United States to design aircraft, engine, and control systems as an integrated unit.

Increasing numbers of engine experts, and particularly electronics experts, make their appearance in the aircraft design groups, and we begin to find much closer cooperation of engine designers or radar system designers with aeronautical engineers so that engines or radars are not planned as independent units but as components of a definite airframe-power-plant-guidance system. On the academic level that trend encourages the training of systems engineers who are familiar with all branches of the aeronautical profession and able to coordinate them.

It would appear that the entire Soviet engineering education system has been geared to systems engineering since its early development, and that, at least in the field of aeronautical engineering, it is well prepared to adjust itself to modern design requirements.

ROTOR TIP BRAKES on XRON-1 Rotorcycle are pedal operated. They are 4 sq. in. in area and have 40 deg. travel.

Tip Brakes Stabilize Coaxial Helicopter

By Russell Hawkes

New York—Small rotor tip-mounted drag brakes are incorporated in the Gyrodyne XRON-1 Rotorcycle as a promising approach to directional control and stability of coaxial rotor helicopters. The brakes turn the fuselage by unbalancing the torques of the counter-rotating rotors.

Failure of directional control in low power or autorotating descents has always been the Achilles' heel of the otherwise well-regarded coaxial configuration.

Pure Drag Force

Pedal-controlled tip brakes of the XRON-1 provide good directional control in all modes of flight because, when extended on one rotor, they exert a pure drag force which is not balanced by the drag of the other rotor. Rotor drag creates a tendency for the torque of the engine to be expended in turning the fuselage and engine block rather than the rotor and drive shaft.

When the tip brakes on both rotors of a counter-rotating coaxial system are retracted the drag forces on the rotors are equal and opposite. In this condition no torque is exerted upon the fuselage because the torque of each rotor is canceled by that of the other. Depression of a rudder pedal of the XRON-1 creates a proportionate and linearly increasing imbalance of torque to turn the fuselage.

Earlier coaxial types have used differential control of collective pitch for directional control. It worked by increasing the pitch and therefore the drag of one rotor relative to the other. Trouble with this system was that it didn't work in autorotation or very low power let-downs.

A control to be effective must be able to exert a force. A rotor unpowered by an engine failure or a radically reduced throttle setting cannot exert a force parallel to the plane of the rotor because rather than driving the air across its surface it is being driven by the air through which it passes.

Without power the rotor is turned by its own lift. Increasing the pitch causes lift to increase more rapidly than drag, tending to turn the rotor faster rather than slower and tending to reduce the torque upon the fuselage rather than increase it. Because of this, directional control either disappears or is reversed.

The unpowered rotor can provide lateral and longitudinal control by spilling the gliding lift off a chosen sector of the rotor disk with cyclic pitch control. The lift of the remainder of the disk tends to tip the helicopter toward the decreased lift sector.

Rudders of the type used on fixed wing airplanes were sometimes added to coaxials for directional control but they require 25 or 30 kts of forward speed to be effective. Landing at these speeds just about requires a prepared strip.

Bendix Helicopters, now out of the business, considered using differential friction braking at the rotor hubs for directional control of a co-axial but the idea never materialized.

Competition Winner

The XRON-1 was co-winner of a 1954 Navy design competition for a cheap, simple, easily packagable one-man helicopter. It has since been undergoing further development.

One of the chief contributors to high cost and complexity of helicopters has been the problem of compensating for torque. Some competition entries were powered by tip-mounted jets or ramjets. Having no powerplant rigidly attached to the fuselage, this design is torque-free.

However, it is penalized by high gross weights resulting from the high jet unit fuel requirements.

Hiller Helicopters, co-winner of the rotorcycle competition, is working with a conventional single rotor and tail rotor configuration. Hiller engineers say they have abandoned coaxials partly, because of their complexity.

NACA tests indicate that the coaxials can lift about 10% more weight per horsepower than comparable tail-rotor designs. Difference is power used by the

tail rotor in compensating for torque. For a given gross weight, the empty weight of a coaxial type is conceded to be 2-5% higher than that of the tail-rotor type. This leaves a fairly good margin of payload in favor of the coaxials.

Russians are known to be developing a very heavy coaxial cargo helicopter which will maximize the payload advantage in absolute terms. They also are working on a lighter two-place coaxial type. Nothing is known of any coaxial cargo carriers being developed in this country.

Jim Ryan, veteran helicopter test pilot now working for Gyrodyne, says that coaxials are easier to fly than tail rotor types. Ryan believes it will be possible to solo a totally inexperienced student in less than four hours of dual instruction in a two-place version of the XRON-1. This fact has great significance in view of the 1954 announcement by the Navy that the Rotorcycle was wanted for the Marine Corps as a means of battlefield transportation and communication. Its use for vertical envelopment operations would require that large numbers of troops be trained quickly and cheaply.

Positive Stability

Coaxial rotor helicopters have the closest thing to positive dynamic stability in hovering flight that Ryan has encountered.

In tail rotor types, directional control must be coordinated with collective pitch and throttle because of the variation in power lost through the tail rotor in heading changes. Conversely, a change in collective pitch requires coordination of directional control because of increased torque on the main rotor. Ryan says that lateral cyclic pitch control must be used as forward speed increases to keep the difference in lift between the advancing and retreating blades from rolling toward the retreating blade.

Coaxial types escape this tendency because there is an advancing blade on each side of the fuselage. A small amount of right rudder is required in forward flight because part of the counter-clockwise turning lower rotor is moved out of the upper rotor downwash by the change in attitude, thus increasing its torque effect. But the partial uncovering of the lower rotor in forward flight also increases the effective disk area, reducing the power required to maintain level flight.

The cyclic and directional controls of the XRON-1 have a positive control force gradient tending to center the controls in the hovering attitude. A light bungee may be added to locate the zero force point of the cyclic control slightly forward in the cruise attitude position. This will reduce the muscular effort required of the pilot slightly. The control force gradient is only 1¼ lbs. per in. of travel.

Touchy Control

The 4 sq. in. area and 40 deg. travel of the rectangular tip brake are considered overly powerful by Gyrodyne engineers. Ryan reports that they make the directional control of the XRON-1 a little touchy. A production version is likely to have the area and/or the travel reduced.

Gyrodyne is now considering the installation of a more powerful engine than the two-cycle Nelson H59 now used.

This would probably result in an increase in the size of the rotor disk from the 15-ft. diameter of the prototype version. Selection of an engine poses a difficult problem since none have been designed specifically for one-man helicopters. The H59 was originally designed for use in a powered glider.

Under consideration are a modified four-cycle, four-cylinder air-cooled automobile engine and a two-cycle, four-cylinder air-cooled target drone engine. Weakness of two-cycle engines is that they lose more power in hot, humid weather and at high altitude than do four-cycle engines. Gas turbine of European design is being studied, but no effort has been made to procure one for modification.

Two-stage transmission of the XRON-1 provides a six-to-one reduction ratio. The free wheeling unit is located between the engine and the transmission. Manually operated clutch combines parallel friction and jaw clutch units. Engaging the clutch involves a two phase operation by the pilot. Placing the handle in the friction position releases a spring load upon the ten alternating driven and driving friction plates. When the driven shaft is in phase with the driving shaft the handle is moved to the jaw clutch position.

Weighs 500 Lb.

The XRON-1 weighs about 500 lb. with pilot and fuel and is capable of speeds over 60 mph. The rotor section resembles a symmetrical NACA airfoil frequently used in helicopter rotors because the center of pressure moves very little as angle of attack changes. Angle of incidence of the lower rotor is about one degree higher than that of the upper to compensate for the upper rotor downwash. Rotor speed used in hovering is about 600 rpm. Tip speed works out to about 500 fps. Disk loading will average about 2.8 lb./sq. ft. and may go higher in operational versions. If a practical gas turbine powerplant is found the disk area may fall and disk loading may rise to take advantage of weight-cheap turbine horsepower.

PUMP PRIMERS

GEROTOR . . .
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Recognized as an extremely attractive theoretical design 30 years ago, there were many abortive attempts to produce Gerotor pumps.

Since then, the W. H. Nichols Company of Waltham, Mass. has built hundreds of thousands of Gerotor pumps for aircraft, marine and industrial applications requiring the highest standards of performance and dependability.

▸ **Advantages** – *The Gerotor pump is a positive displacement type, delivering a predetermined amount of fluid in direct proportion to speed. It is simple and compact in basic design, (only 2 moving parts) lightweight, valveless, provides high volumetric and mechanical efficiency and offers exceptional performance at high altitudes where low inlet pressures are encountered.*

▸ **Operating cycle** – The Gerotor pump is a form of internal gear pump in which the inner element *always has one less "tooth"* than the outer. Both turn in the same direction. The volume of the missing tooth multiplied by the number of driver teeth is the volume of fluid pumped per revolution. Either the inner or outer Gerotor can be driven.

The Gerotors are mounted on fixed centers eccentric to each other. As they turn, the chamber between the teeth of the inner and outer Gerotor gradually increases in size through the initial 180° of revolution until it reaches the full volume of the missing tooth.

During this first half-revolution, the gradually enlarging chamber passes the intake port, creating a partial vacuum into which liquid from the port flows.

In the second 180° the teeth mesh, decreasing the size of the chamber as it passes the discharge port, forcing the liquid out.

▸ ***Technical Data** – is available and your inquiry is invited. Write:*

FIG. 1

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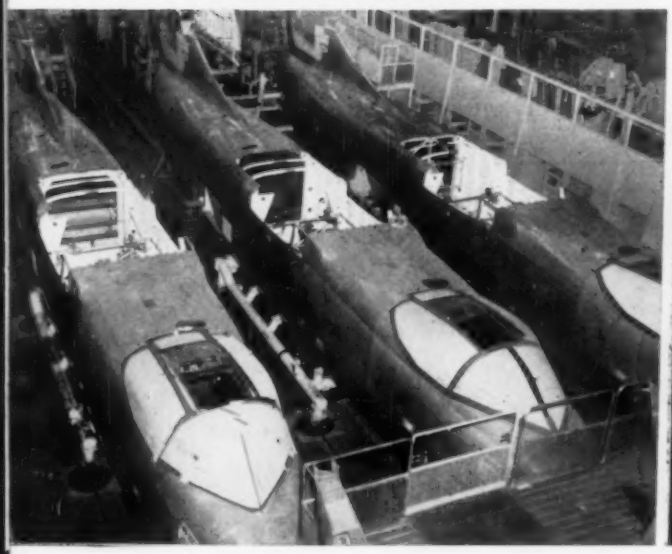
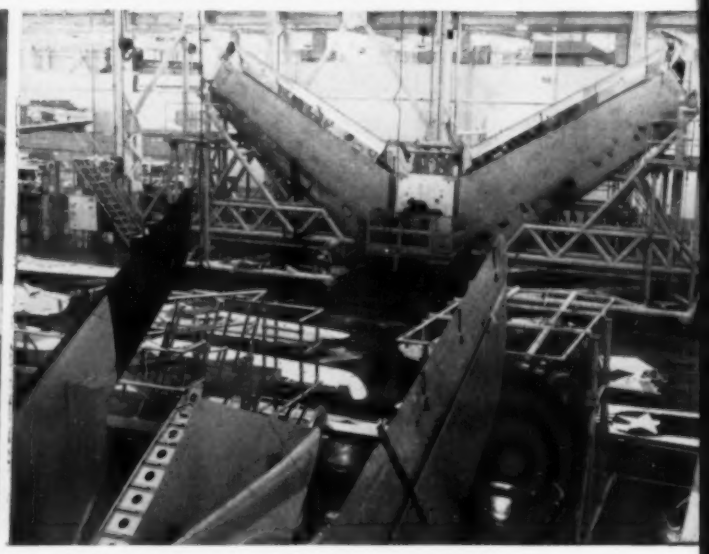




FUSELAGE LINE carries three units abreast (left). Wing mating jig (right) shows inner panels hooked to center section.

Skywarrior Custom Built for Attack

By Irving Stone

El Segundo, Calif.—Even though it is the world's largest carrier-based plane, the Douglas A3D Skywarrior has been structurally tailored to the minimum size and weight to meet its long-range attack-bomber mission.

Holding the plane's gross weight to 70,000 lb. in the face of projections for much larger weight figures (AW Dec. 13, 1954, p. 28), designers of the A3D developed a sturdy, compact structural arrangement of minimum complexity to meet the rigors of carrier service.

Fuselage structure of the A3D, principally built of 7075S, actually begins at the aft end of the radome, which is a large plastic enclosure housing radar equipment.

Nose Bulkhead

The nose bulkhead serves two functions. Upper portion seals the pressurized cabin, while the lower portion provides a support for the forward end of the nose landing gear support beams. Top of these beams carry the pilot's floor and are laterally stabilized by the floor.

Bottom, extruded caps of the nose landing gear support beams provide keel members which are carried aft as far as the bomb bay. Outboard of these keel members are other keel members which extend from the aft end of the nose wheel well to the tail turret.

In the region between the aft end of the nose wheel well and the forward end of the bomb bay, heavy plating is used to carry the loads between the inboard and outboard keel members. The combination of keel and plating structure also provides a local strong point for the attachment of the catapult hooks, which are located just forward of the bomb bay.

Crew compartment is located immediately above the nose wheel well. Just aft of this compartment, the upper portion of the fuselage is occupied by a self-sealing fuel tank, while the lower section contains auxiliary power drives and equipment.

Aft of this area is the bomb bay, which extends the full depth of the fuselage. Shape of the bomb bay is essentially rectangular, as dictated by bomb stowage requirements, and this rectangular shape is carried forward and aft to determine the general shape of the fuselage. Bomb bay is located approximately on the center of gravity of the airplane to avoid excessive trim change during bomb drops.

As a result of the large size of the bomb bay, extensive buffeting was encountered in flight with the doors open. This condition was remedied by installation of a deflector plate at the forward end of the bomb bay. The deflector extends with the bomb bay doors.

Main landing gear also had to be located close to the C.G. to provide proper takeoff and landing characteristics. Having the gear in this area together with the bomb bay posed a problem of stowage. This was solved by an ingenious retracting mechanism which brings the gear and wheel aft along an angular path so that the wheel will fit vertically into a shallow-width area in the fuselage.

Outstanding feature of the landing gear is its size for carrier operation. Main gear strut diameter is 7½ in., wheel diameter is 43 in. Nose gear strut diameter is 5½ in., wheel diameter 15.4 in.

Strut material is Hy-Tuf steel heat-treated to the 230,000-psi. range. Fittings have been welded to the strut barrel.

Jato Support

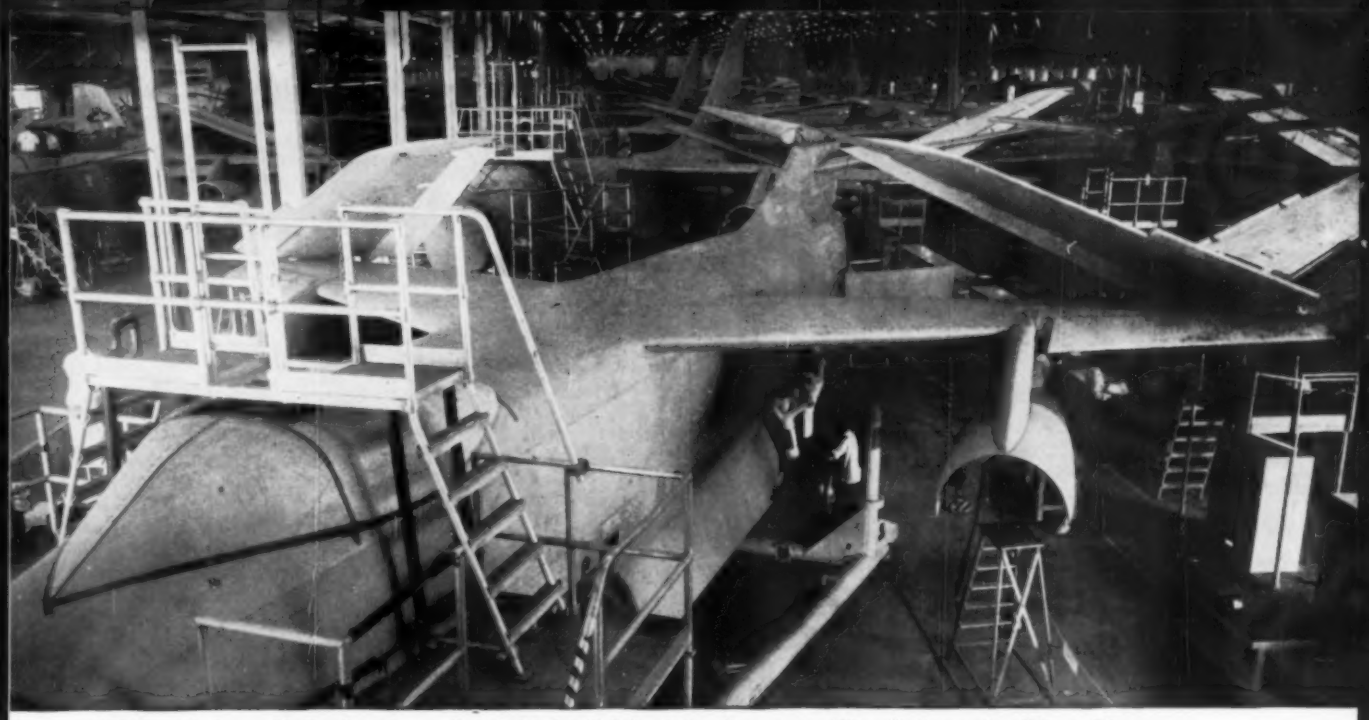
Between, above, and aft of the wheel wells is another self-sealing fuel tank. Aft of this fuel tank area, back to the tail turret, the fuselage contains only minor equipment. In this region the fuselage structure is designed to support JATO bottles, used for takeoff under emergency conditions only.

Aft of the bottle attachment area, speed brakes are hinged. These are built-up sheet metal units, which are operated by extending to the fully opened position only.

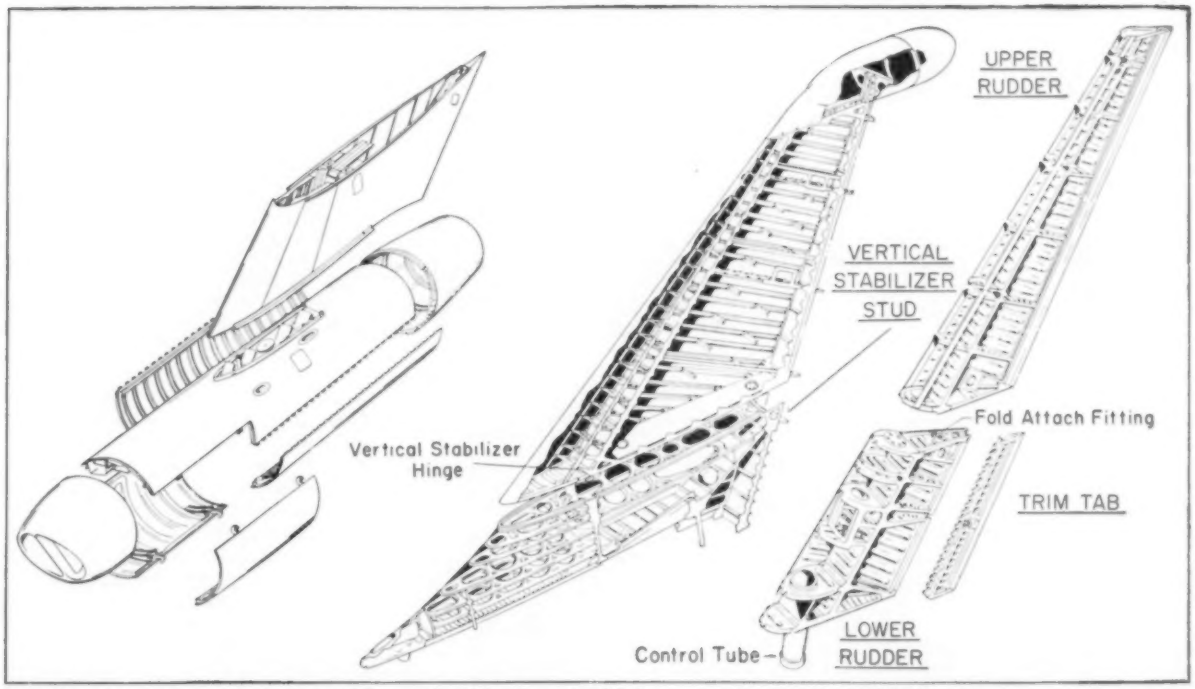
Below the forward portion of the speed brakes is the tail bumper, consisting of a sheet metal yoke carrying a small solid rubber-tired wheel and a shock strut.

Aft of the tail bumper is the arresting hook. This is a very large unit, measuring 3¼ in. in diameter. This size is required because of the large load imposed on the hook when the plane is being stopped.

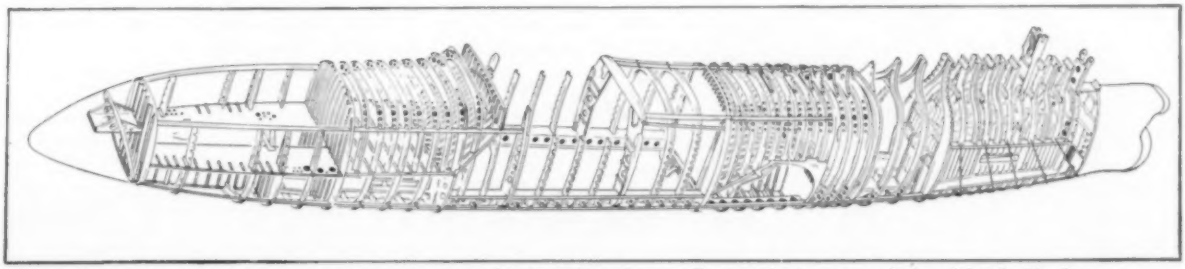
Both the arresting hook and the tail bumper are attached to the heavy keel



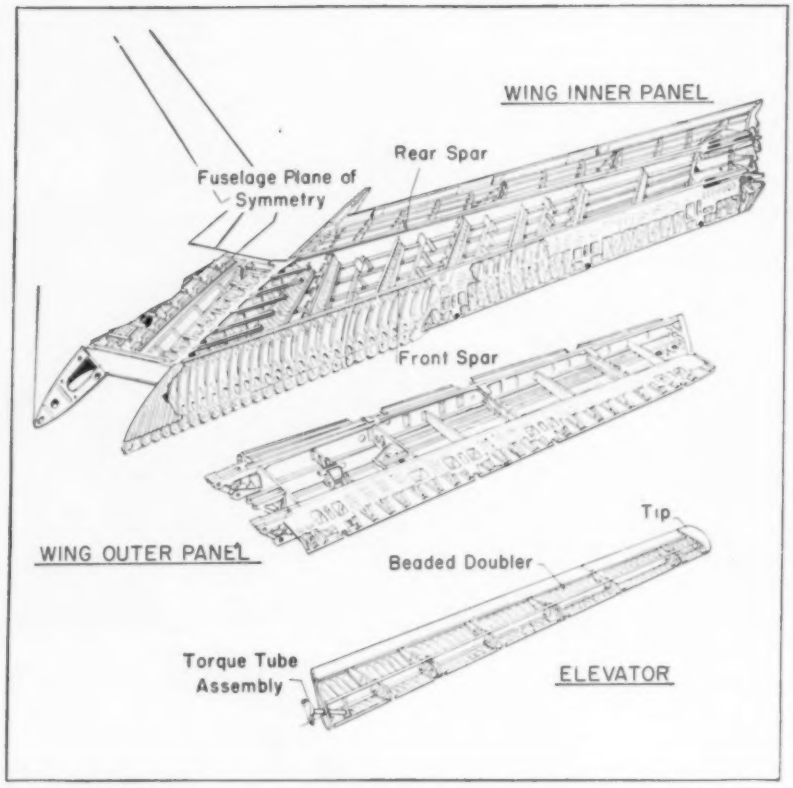
A3D-1 on final assembly line has wings and vertical tail folded, bomb bay doors open. Wing fits in opening (left, p. 66).



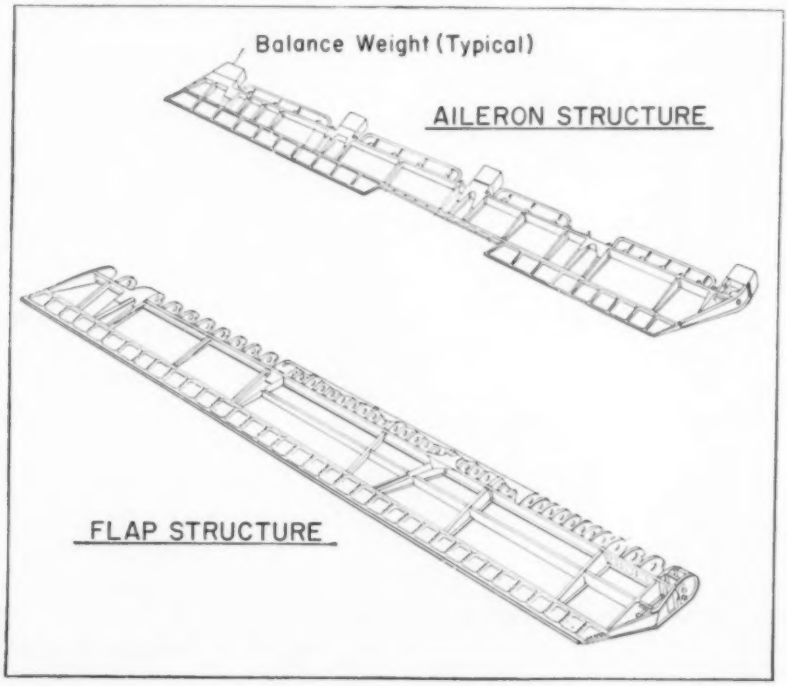
DETAILS of structure of the vertical stabilizer and rudder show simplified two-spar structure to simplify fold joint.



SCHEMATIC of fuselage shows concentration of main and intermediate frames. Some main frames are designed for double duty.



WING STRUCTURE also is essentially a two-spar arrangement. Because of thickness of skin (¾ in.) design of joint between inner panel and center section (top) was complicated, but overcome by careful detail design. Skin tapers down to .032 in. from fold joint to tip. Ribs are spaced about 30 in. apart. Spars have sheet metal webs and relatively small extruded caps for attachment of skin. Fold fittings, which are larger than usual in carrier planes because of necessity of folding larger than usual outer panel, have been machined integral with wing spar caps to reduce weight. Flap and aileron (below) have spar to take bending and skin to take the torsion.



members which frame the bomb bay and extend aft.

Fuselage skin is supported by hat-section stiffeners, formers and main frames. Effective utilization is emphasized for some of these main frames by designing and locating them to do double duty. For example, the arresting hook support frame also provides for the attachment of the vertical tail front spar.

Another single frame carries the speed brake hinges, tail bumper attachment, and JATO bottle mounts.

The closing frame at the aft end of the bomb bay also accommodates attachment of the main landing gear.

Vertical tail is a two-spar structure without longitudinal stringers. This makeup was selected to simplify the fold joint incorporated to meet hangar deck clearance. In this arrangement, all bending is taken by the spars and torsion is carried by the skin. Ribs are used to maintain skin contour and allow a reasonable skin panel size.

Tail Structure

Horizontal tail internal structure consists of two spars, hat-section stringers, and ribs which serve as supports for elevator hinge points.

Wing is attached to the top of the fuselage, over the forward end of the bomb bay. Sweep is 36 deg., aspect ratio 6.75, and thickness tapers from 10% at the root to 8¼% at the tip.

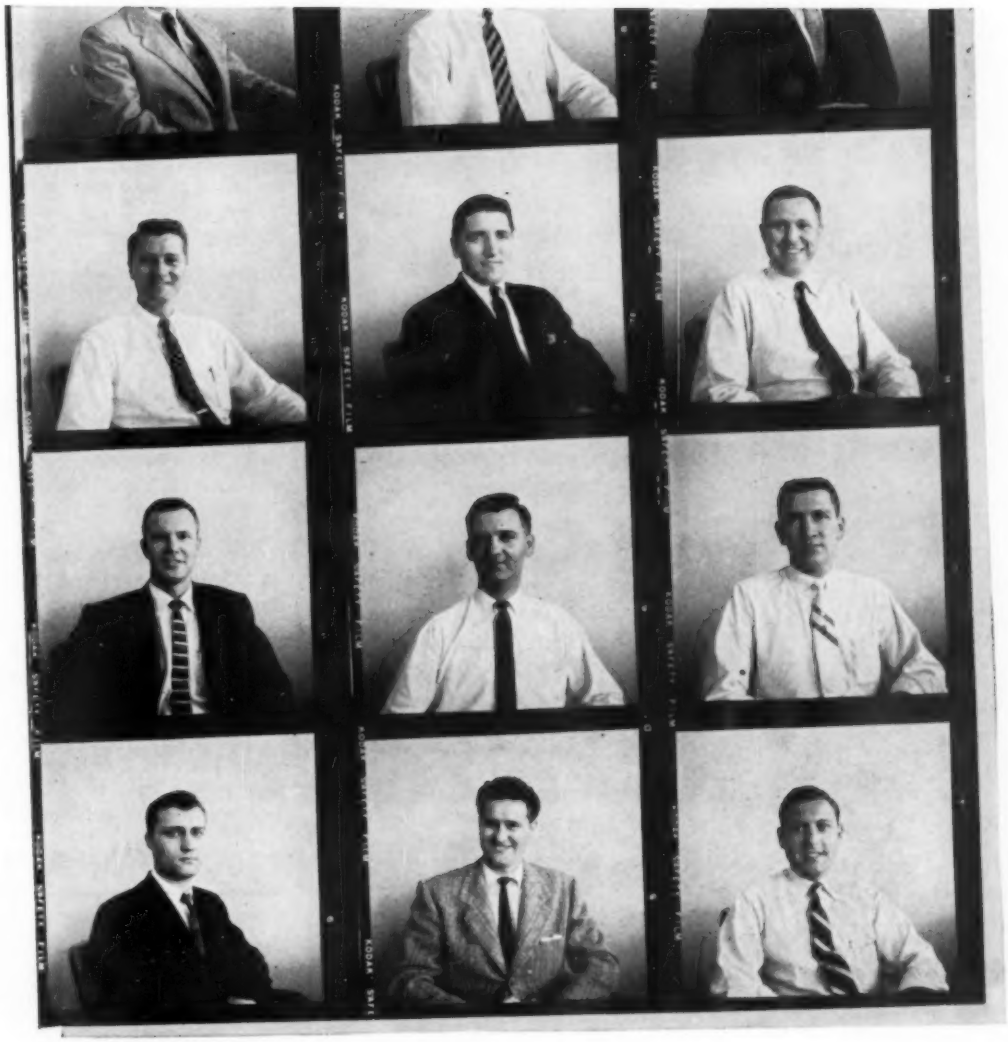
Wing structure is essentially a two-spar arrangement, with heavy skin and ribs spaced about 30 in. apart. Spars have sheet metal webs and relatively small extruded caps for attachment of skin. Area from wing root to fold joint between spars is an integral fuel tank.

Initially it was intended to use a tapered skin, but a check of the deflection characteristics with this skin indicated that unsatisfactory lateral control and flutter characteristics would result. Further study showed that the most economical structure, from weight and cost standpoints, would be a 7075S sheet of constant ¾ in. thickness from the root to the fold joint. From this joint to the tip, the skin is tapered in steps from ¾ in. down to .032 in.

Thickness of the skin, with its accompanying relative lack of flexibility, presented a big problem in the design of the joint between the inner panel and the center section. A joint of adequate strength and fatigue life was ultimately achieved by careful detail design coupled with extensive laboratory experimental work.

Size of the A3D required that a larger-than-normal outer panel be folded for carrier handling. Because of this the fold fittings and operating mechanism are larger than are usually found in carrier planes.

To reduce weight of the fold fittings



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on both inner and outer wing panels, they have been machined integral with the wing spar caps. To provide material for these fittings, stepped extrusions have been used.

Construction of control surfaces, including flaps, is generally similar. Make-up consists of a spar to take the bending and skin to take the torsion. Skin consists of a smooth external sheet coupled with a beaded inner doubler which serves as a stiffener, eliminating a large number of ribs.

Balance weights are continuous along the leading edge on the rudder and elevator. On the aileron, since space was not available for continuous weights, four concentrated weights are provided, equally spaced along the leading edge.

Rudder and aileron have trim tabs, while longitudinal trim is obtained with the adjustable stabilizer.

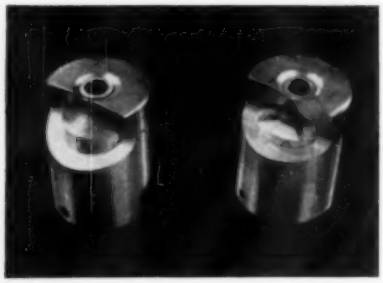
Spoilers consist of a V-shaped extrusion and a sheet metal closure channel. They are located on the upper surface of the wing, just forward of the wing flaps at the outboard end of the inner wing panels. A large gain in rate of roll at high speed is obtained with the spoilers because they cause a very small increase in wing torsion.

Engine nacelles provide for easy access from the ground. Entire nacelle is comprised of a nose ring, tail ring, fixed top section, and four hinged panels covering the side and bottom.

PRODUCTION BRIEFING

Miniature Precision Ball Bearings Inc., Keene, N. H., reports that the miniaturization trend in equipment which increased its business 30% in 1955 is continuing to increase the demand for its products. It is over the million-a-year mark in miniature ball bearings (those under ⅜ in. O.D.)

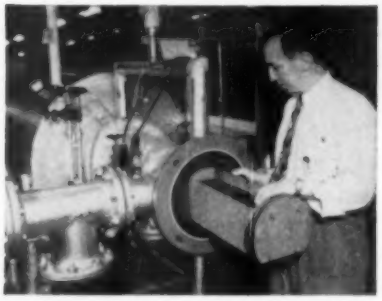
North American Aviation, Inc., Los Angeles, Calif., is replacing the female half of their flush rivet recess dimpling dies with a new company developed pattern which they say will save thou-



sands of dollars annually on tool replacement costs. Main difference of the new design, pictured to the right, is the two piece ram. The separate upper part now has parallel sides and

the hole which receives the male pilot punch is drilled all the way through. These changes lessen the effect of wear and help to clear chips.

Heat treating furnace for small precision stainless steel parts is able to heat treat stainless steel parts after final machining without distorting or discoloring them, the manufacturer, Allied



Products division of Hamilton Watch Co., reports. Process is carried out in several stages in specially controlled atmospheres. Facilities, which were developed for Hamilton's watch parts, will be available to outside firms.

Workmen erect a new type of prefabricated roof. Individual 2 ft. wide sections of 18 gage galvanized steel prestamped to a curved "gutter" shape are bolted in place to form a 120 ft. span arch. Called "Wonder Roof" by the maker, Wonder Building Corp. of

America, Chicago, Ill., the roof's first commercial trial has been in this coliseum for Phoenix, Ariz. The 260 ft. long roof was erected in 7½ working days, according to the builder. Cost of the roof is 75¢ per sq. ft. for materials and 15¢ per sq. ft. for erection.

Brooks & Perkins, Inc., titanium and magnesium fabricator, Detroit, Mich., has opened a new division in North Hollywood, Calif. It will be able to handle complete engineering programs as far as prototypes. Naval Research Laboratory has just awarded firm contract for the Earth Satellite (Project Vanguard). Satellite will be made of magnesium alloy (AW July 16, p. 28).

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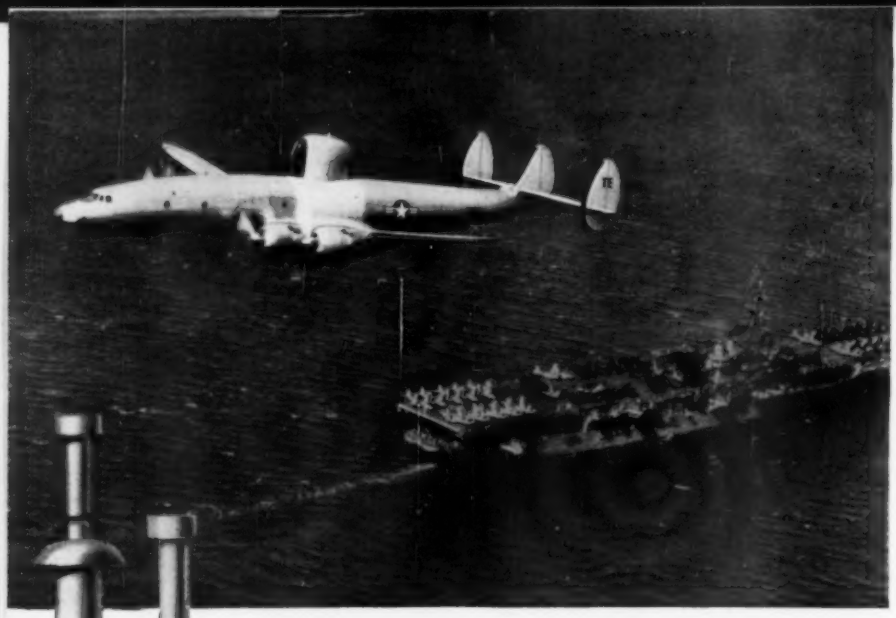

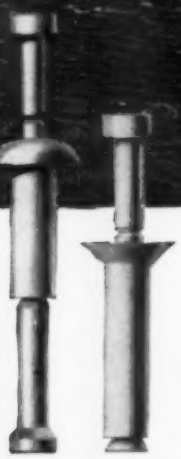

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The Lockheed WV-2, flying-eye radar plane and the carrier load of fighters it can direct into battle when it electronically spots danger in front of the fleet, is the U. S. Navy's newest sky-and-sea fighting team.

The giant Super Constellation-type airplane with its crew of thirty-one is designed to bolster U. S. defensive power over its vast ocean approaches. It will fly the fringe of fleet units to warn of unidentified air or surface craft and then electronically guide combat planes from carriers or shore bases to investigate. The long-distance Lockheed plane carries America's most powerful search radar to high altitudes to avoid normal limitations from radar's inability to bend over the horizon.

Back of this sky-and-sea teamwork is the similar teamwork of Cherry Rivet research and development men who cooperate with Lockheed engineers to produce the precision fasteners used in the WV-2 and other aircraft. From long association with the aircraft industry, Cherry engineers have developed the widest range of types and sizes of blind rivets available in the industry. They have designed and built special purpose machines and developed techniques that make possible the production of precision rivets and give the Santa Ana plant the largest blind rivet capacity in the world.

The necessary guns, tools and accessories for setting blind rivets are also designed, developed and manufactured entirely in the Cherry Rivet plant at Santa Ana which is devoted exclusively to aircraft production.

With this background of experience, special techniques, modern equipment and tremendous capacity, it is understandable that Cherry rivets are widely used in the aircraft industry to speed production, improve design and reduce unit costs. For technical data on the entire Cherry line of fasteners and tools, write to Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

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In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario*

Tests Show Comet Fuselage Stronger

How the de Havilland Aircraft Co. convinced Capital Airlines and its financial backers of the soundness of the Comet whose reputation was clouded by two Comet I crashes in 1954 was indicated last week by the company following announcement of the Capital order for 14 Comet IVAs.

Tests in a water pressure tank, and study of wreckage showed that fatigue, beginning at specific weak points at cabin windows, caused explosive decompression of the pressurized cabins of the Comet Is that crashed (AW Oct. 25, 1954; Feb. 7 and 14, 1955).

"Throughout," de Havilland said of the IVA, "the aim has been to employ a new formula of detail design to every component of the airframe to ensure a high resistance to fatigue as well as adequate static strength—a much easier requirement to meet.

"In the fuselage the use of 19 s.w.g.-section skins fulfills the design requirements for the pressure cabin, giving a maximum level of nominal stress of 22% of the ultimate. In addition, by carefully grading and reinforcing the structure in the vicinity of the windows, doors and other cutouts in the fuselage, the stress level at these positions—which are the normal sources of fatigue—is further reduced to the point where fatigue cracks are unlikely to form during the operational life of the aircraft, and that if they should occur they would propagate so slowly that they would in no sense be dangerous."

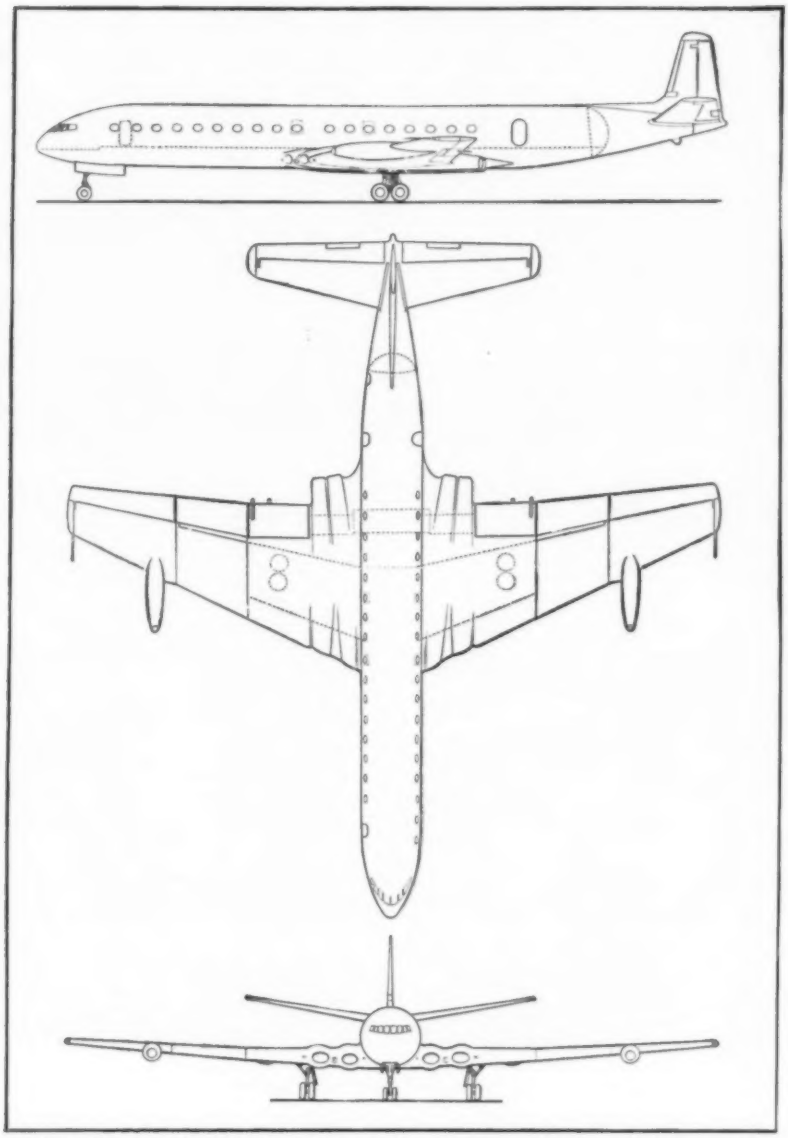
Tests results stated by de Havilland:

- **Factors over six** without cracking have been achieved on fuselage components, and a further factor of six after cracking occurred.
- **Water tank tests** like those by which the crash mystery was solved, have shown a 29-ft. fuselage section containing all types of cut outs has undergone 85,000 reversals of pressure without a failure.

(On the basis of each reversal representing a three hour flight, de Havilland said, this represents, with the scatter factor of six applied, more than 42,000 hours.)

- **Fuselage center section** to which wing loads are applied, has achieved 30,000 reversals; a nose section with canopy, 100,000 reversals.
- **Altitude chamber tests** carried out in deference to those who expressed doubt of the validity of water tank tests in assessing fatigue life of pressurized fuselages, have tallied closely with water tank results. Reversals were carried out on box structures containing typical fuselage cutouts.

These typical cutout structures, as de Havilland described a window, are mounted in 18 s.w.g. metal panels pro-



COMET IVA: Length, 114 ft.; height, 25 ft.; main span, 107 ft.; wheel base, 50 ft.

ducing a nominal stress of 18.3% of the ultimate.

In the vicinity of a cutout, a doubling plate is reduced to this section, and the cutout itself is surrounded by a further doubling plate of 14 s.w.g. and by the window frame structure. Cabin windows are of double Perspex construction, the outer panel the load carrying member. De Havilland believes they probably are the strongest ever made and have been statistically tested up to more than 31 times normal working pressure.

All riveted joints in the fuselage have been subjected to a close design study.

Wing structure has been exhaustively tested for static strength and fatigue life with satisfactory results, de Havilland said. Design in the IVA remains similar to the earlier versions, except that naturally aged copper-based light alloys have been used in the tension booms and bottom skin to improve fatigue life.

De Havilland also revealed some details of how the Comet IVA will be operated on short and medium hauls to achieve competitive economy. At 23,500 ft. the Comet cruises between 520 and 545 mph. depending on ambient temperature. At the lower altitude, the true airspeed is increased relative to the limiting Mach number, and the increase compensates for the increased fuel consumption.

Furthermore, the rate of climb and descent are increased, giving maximum possible distance for high speed level cruise, thus reducing block time.

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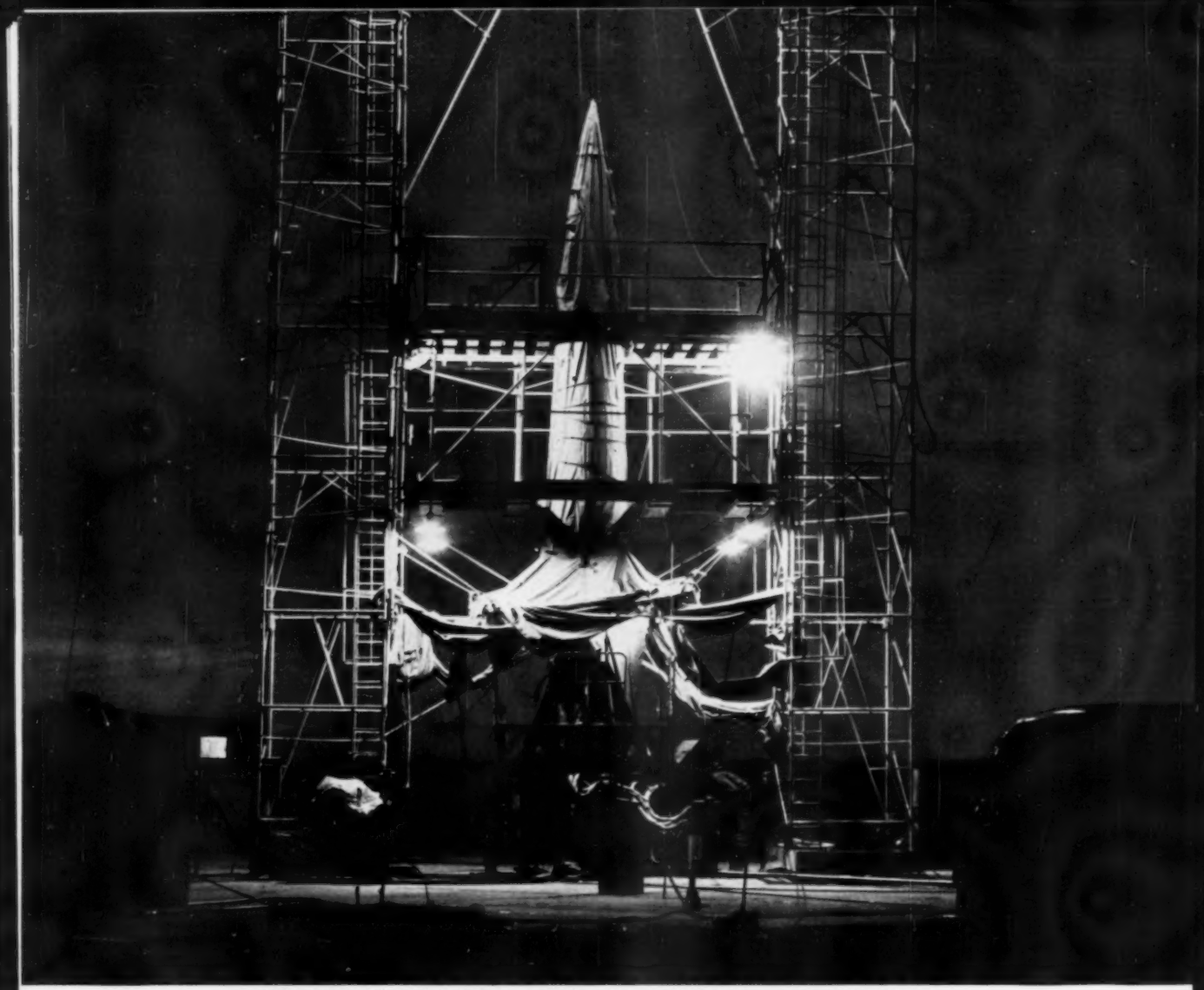
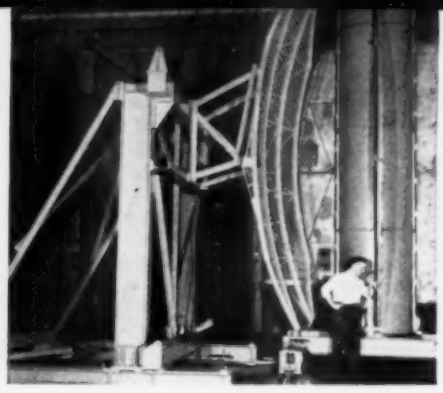


ZERO minus 4 hours! A G-E test missile, still shrouded in the early morning dampness before launching, represents more than a decade of research and development.

THESE G-E CAPABILITIES ARE AVAILABLE TO

BASIC RESEARCH



COMMUNICATIONS

HYPERSONICS

At General Electric, George F. Metcalf reports:

New Department to Help Solve Complex Defense System Problems

GEORGE F. METCALF, is General Manager of General Electric's new Special Defense Projects Department, located in Philadelphia, Pa. Mr. Metcalf has had extensive management experience in the military electronics field, both in Government Service and in the General Electric Company's Electronic Division.

Realizing the increased complexity of some of the nation's current defense system problems, General Electric has formed the Special Defense Projects Department. The new department will act as a Company focal point for large, highly complex missile projects. Headquarters for the new department will be located near Philadelphia, Pa. This new department has responsibility for large defense systems that require the combined research, development, and manufacturing resources of many of General Electric's operating departments and laboratories.

Manned by a highly skilled engineering and development staff, the Special Defense Projects Department relies upon General Electric operating departments and laboratories for many specialized phases of its defense projects.

The Special Defense Projects Department is making significant contributions to America's defense program by focusing the wide range of specialized talents of General Electric on highly complex defense system problems. Section 224-4, General Electric Co., Schenectady 5, N.Y.

ENGINEERS: G.E.'s Special Defense Projects Department is currently expanding its staff of highly skilled engineers and scientists. If you have a background of successful, creative engineering send your qualifications to: Mr. George Metcalf, 3198 Chestnut St., Special Defense Projects Department, General Electric Company, Philadelphia, Pa.

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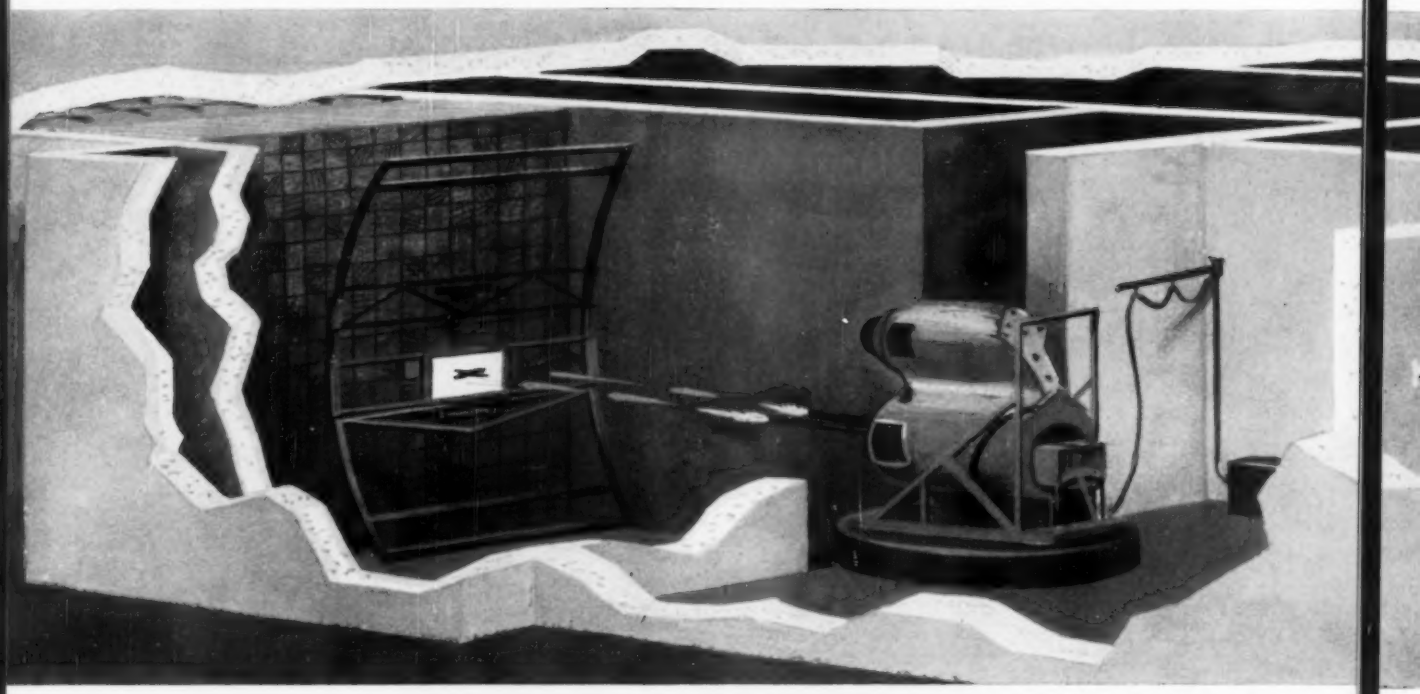
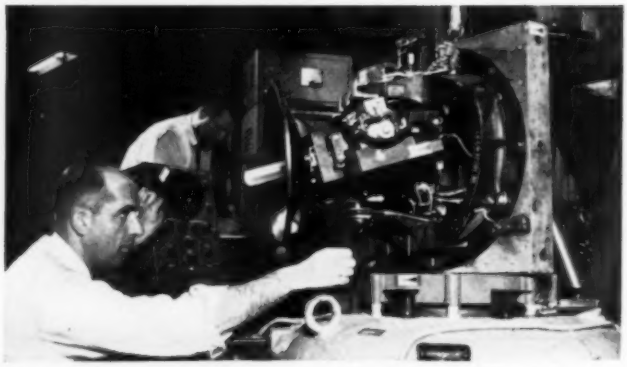
Here's How Facilities at General Electric Speed



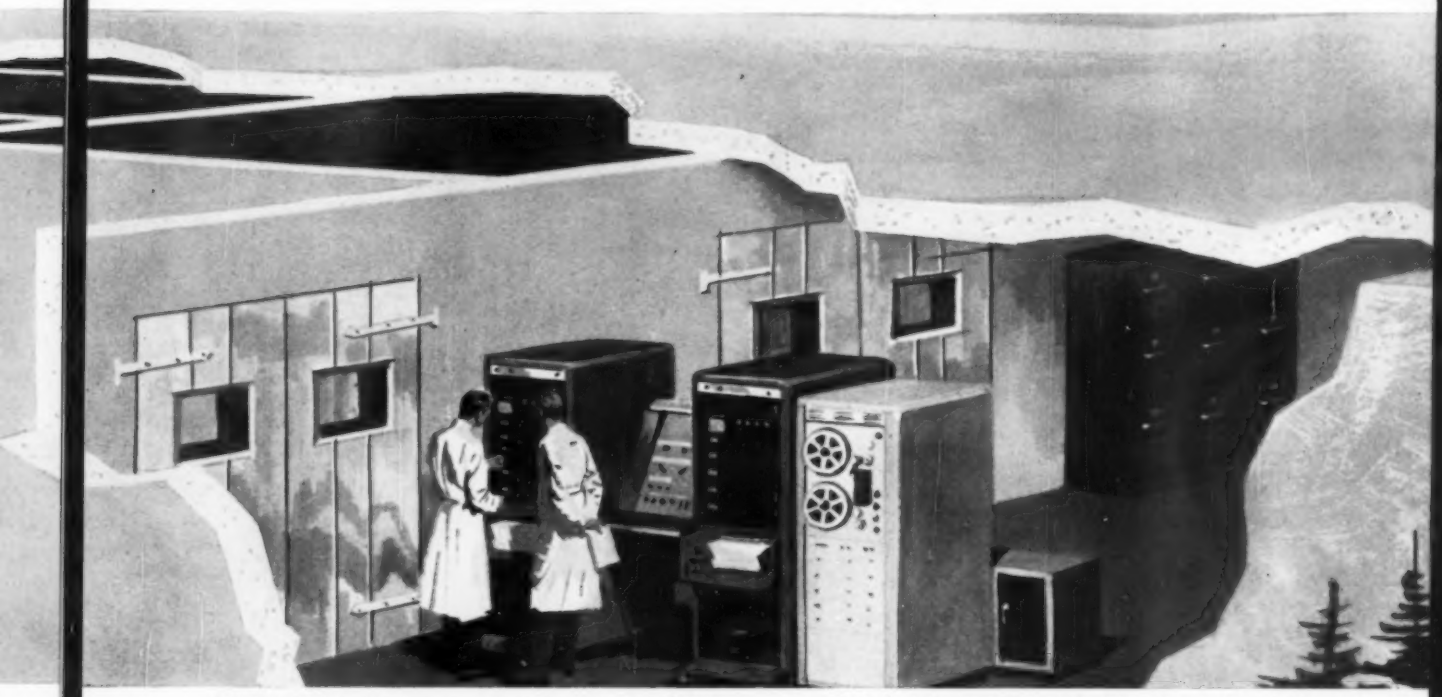
ENVIRONMENTAL TEST CHAMBER simulates atmospheric conditions found at altitudes up to 100,000 feet.



AIRBORNE EQUIPMENT such as the radar antenna being tested here is subjected to severe vibration tests.

DIGITAL COMPUTER, designed and built by General Electric, is used to help solve airborne defense system problems.

Electronic Bomber Defense System Development



DYNAT (**DYN**amic **A**ccuracy **T**ester) simulates flight conditions and combat situations on an indoor test range, minimizing costly flight tests and reducing qualification time. Located at General Electric's Aircraft Products Dept., this installation permits all-angle fire testing of electronic bomber defense systems at temperatures ranging from —100F to 160F.

G-E Facilities Help Researchers Anticipate and Solve Problems Prior to Airborne Tests

Cutting lead time in the development of aircraft equipment has become increasingly important. All possible measures must be taken to reduce development and testing time in order to speed delivery of operational aircraft to our armed forces.

General Electric test facilities provide an important means of reducing development time of airborne defense systems. The test facilities pictured here help experienced G-E personnel to analyze and solve problems difficult if not impossible to duplicate by flight tests. Just as important is the saving in valuable time and reduction in expense of airborne testing. These facilities help make the saving possible—speeding the development of aircraft defense systems for tomorrow.

Engineers: Expanding electronic bomber defense projects at G.E. are creating opportunities for you. Contact C. E. Irwin, General Electric Company, Aircraft Products Department, Johnson City, N. Y. 222-3

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Circuit breakers

B-52 Defense System Uses Two Radars

By Philip J. Klass

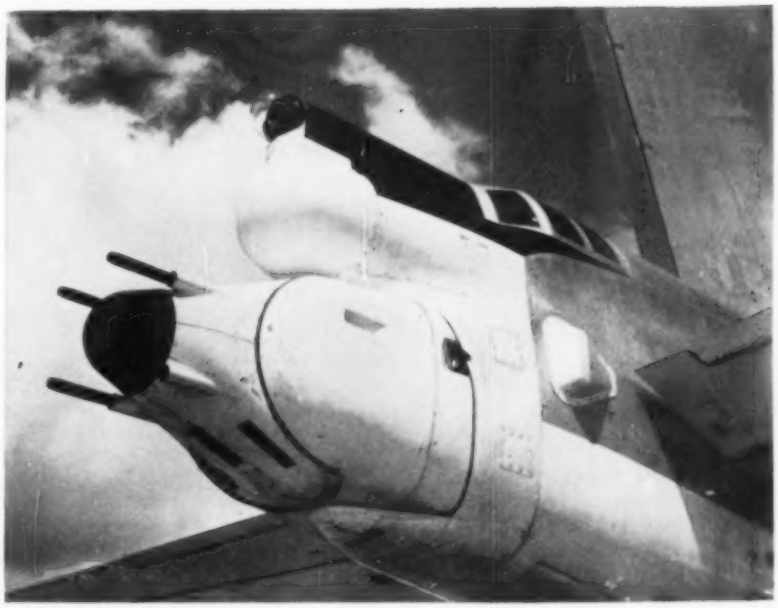
Several significant new bomber defense techniques, including a new type radar, are making their first production appearances in the B-52's automatic radar-controlled tail stinger, developed and produced by the Arma Division of American Bosch Arma Corp.

A3-A armament system also marks Arma's first prime contractor role in the bomber defense field—almost the private preserve of General Electric since it developed remotely controlled gun turrets during World War II. B-52 armament system weighs 2,500 pounds (less ammunition), costs about $200,000 per system, and uses 350-400 vacuum tubes.

One of the most significant of the new techniques is the use of two separate radars, one for search and the other for aiming the tail turret which mounts four .50-cal. machine guns. Although the dual radars add weight and complexity, they provide several operational advantages over previous systems which use a single radar for search and track functions:

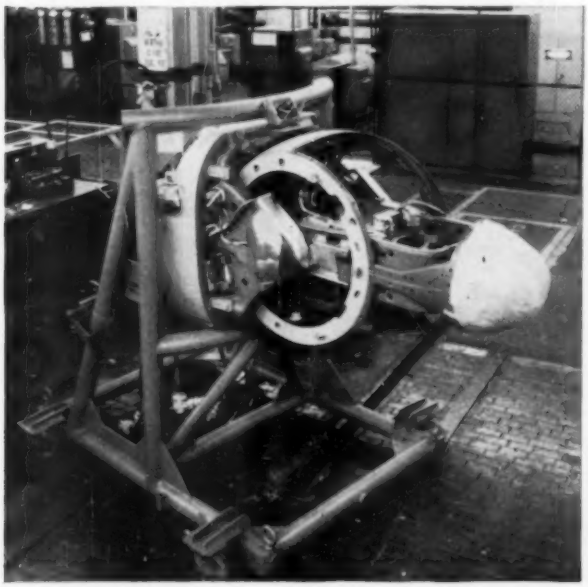
• **Simultaneous search and track.** Tail gunner in the B-52 can be scanning the skies for other enemy aircraft while his tracking radar and turret is countering an immediate attack.

• **Improved performance.** Use of separate radars permits each to be tailored for optimum performance at its specific task. Search radar needs maximum possible range. Tracking radar, on the other hand, need have only modest range but must give extremely accurate and smooth data on target position, velocity, range, and rate of closure.



B-52 BOMBER defense system, developed by Arma, provides separate radars for search and tracking (center and bottom) radomes and a periscopic sight for optical tracking (top).

Another innovation is the first use of a new type of radar, called monopulse, for the tracking function. Developed and manufactured by General Electric's Light Military Electronic Equipment Department, monopulse reportedly provides greater accuracy and



B-52 TAIL TURRET (left) before assembly process. Complete armament package (right) containing turret, radars and hemispheric sight being mounted.

smoother data than that available from conventional conical scan radars. In conical scan radar, the beam is caused to rotate about the position of the target and requires transmission and reception of a number of pulses to establish target location.

In monopulse, the radar is able to establish target position from a single pulse by simultaneously transmitting two or four beams and measuring the phase and/or amplitude relationship between their respective target returns.

An Arma spokesman says that monopulse radar gives the system an accuracy which is several times better than that obtained with previous bomber defense systems. An interesting sidelight is the report that the GE monopulse radar gave the Arma B-52 armament system a decided performance edge over a competitive system developed by GE's own Aircraft Products department which employed conventional conical scan radar.

New Control Technique

The Arma B-52 tail stinger is the first production bomber defense system to employ the "floating line-of-sight" control technique pioneered by the Massachusetts Institute of Technology's Instrument Laboratory, under Dr. C. S. Draper. This is an adaptation of the "floating reticle" technique used in World War II gunsights for inhabited gun turrets.

When GE developed remote control gun turrets during World War II, it applied the director principle of aiming the gun turrets—an adaptation of the technique used in aiming naval gun batteries.

In the director-type system, now used in the GE tail stingers for the B-36, B-47 and B-66, the radar antenna and turret move independently. Radar continuously points at the target (during track mode), providing information on target position, velocity, range and rate-of-closure. From this data a computer calculates the angle by which the turret must be advanced (or retarded) from the radar's aiming point to provide lead (prediction) and ballistic corrections.

In the Arma floating line-of-sight system, the tracking radar rides on the gun turret, mounted on an independently driven servo operated gimbal system. Thus the tracking radar antenna is positioned by the turret, but its line-of-sight is advanced or retarded relative to the gun aiming point by means of the independent gimbal system to provide lead and ballistic corrections.

There are strong proponents for both the director and floating line-of-sight type systems, and advantages to each. One problem in the floating line-of-sight system arises because the tracking radar antenna is mounted close to the guns and therefore subject to vibration and shock caused by gun blast. Unless the antenna is suitably isolated, it can affect radar performance adversely.

At the present time Arma ships its B-52 armament system as components which are later assembled into a tail package at the Boeing plants. However, negotiations are under way for Arma to build the complete tail package and assemble the major components prior to shipment, in the pattern of the approach used by GE in its B-47 bomber defense system.

Although the Arma system is designed for fully automatic radar tracking of the target, the B-52 carries a gunner in the tail. His job is to monitor the search radar scope, determine which targets present the most serious threat, then lock his tracking radar onto that target.

A horizontal periscopic gunsight, located atop the search radar antenna, permits the gunner to search or track targets optically and direct the turret in event of radar failure or enemy countermeasures. The gunsight, manufactured by Eastman Kodak Co., is believed to provide full rear hemisphere coverage.

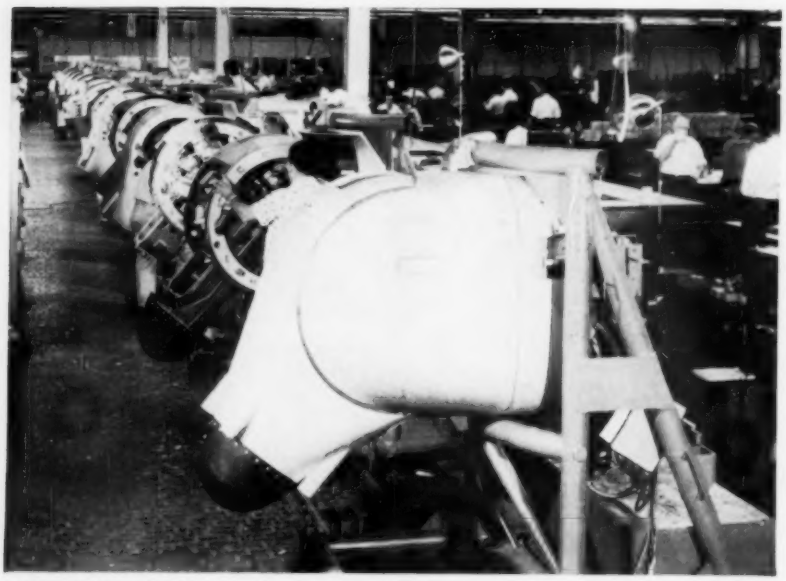
No figures have been released on the coverage of the tail turret itself. However it appears that the tail turret can cover a sector of more than 90 deg. (±45 deg.) in both azimuth and elevation. The turret is driven by hydraulic actuators instead of electric motors used in previous turret drives.

Crosley Division of Avco Manufacturing Co. has been set up as a second source for production of the Arma B-52 system. Crosley has been a second-source producer of the GE bomber defense systems for the B-47. Arma reports that it is subcontracting about 40% of the systems which it turns out.

Future Developments

Arma spokesmen report that the company is developing more advanced versions of the A3-A system which it is now producing. These developments are believed to involve the use of more potent weapons, including perhaps the recently developed Gatling type multi-barrel machine gun.

Arma also is working on transistorized computers and servo control systems. The present computer is of the analog type, but the company is studying the possibility of using digital computers.



ARMA PRODUCTION line shows B-52 tail turrets in process of assembly. Black radome covers new GE Monopulse tracking radar.

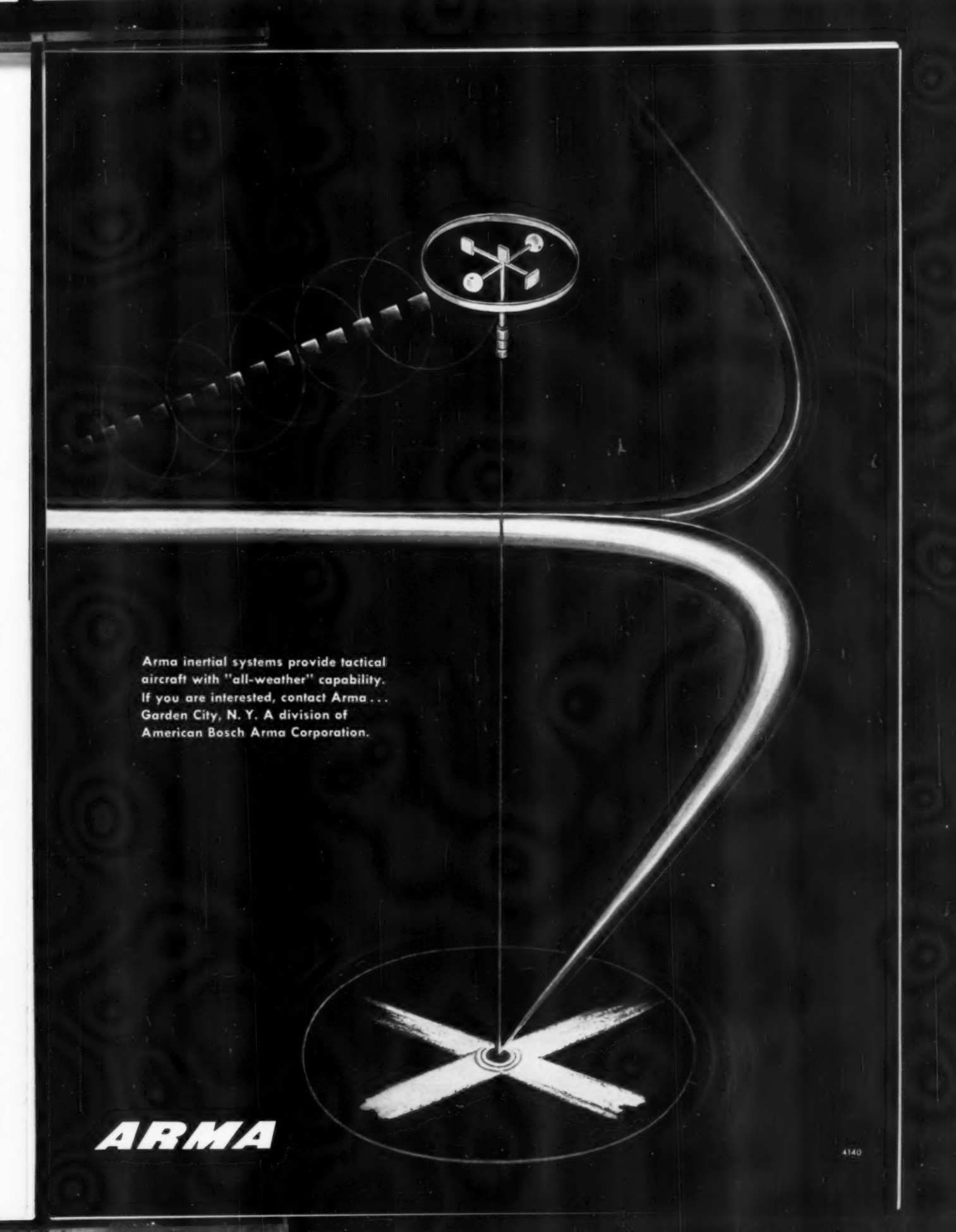
Expansions, Changes In Avionics Industry

Systems Inc., Orlando, Fla., is name of newly formed company which will specialize in systems analysis of missile systems, radar vulnerability to countermeasures, electromagnetic, communication and information theory. Company will also do research and development in radar, ECM and infrared systems. Firm is headed by Sidney M. Kaplan, formerly of General Electric. William H. Horton and Robert H. Dickinson are vice presidents.

Company address: 2326 Diversified Way.

Other recently announced changes and expansions in the avionics industry include:

• **Tele-Dynamics Inc.** is the new name of Raymond Rosen Engineering Prod-


Arma inertial systems provide tactical aircraft with "all-weather" capability. If you are interested, contact Arma . . . Garden City, N. Y. A division of American Bosch Arma Corporation.
ARMA
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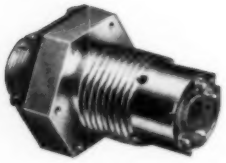

This is a Honeywell Thermal Sensor which converts minute cooling variations into electrical signals. Honeywell has harnessed these signals for use in liquid level sensing systems having response times of from one to four seconds. These systems are ideal for in-flight and ground refueling, center of gravity control, and independent high and low level warning systems. Lightweight, simple, safe, they are vital to precision aircraft fuel management.

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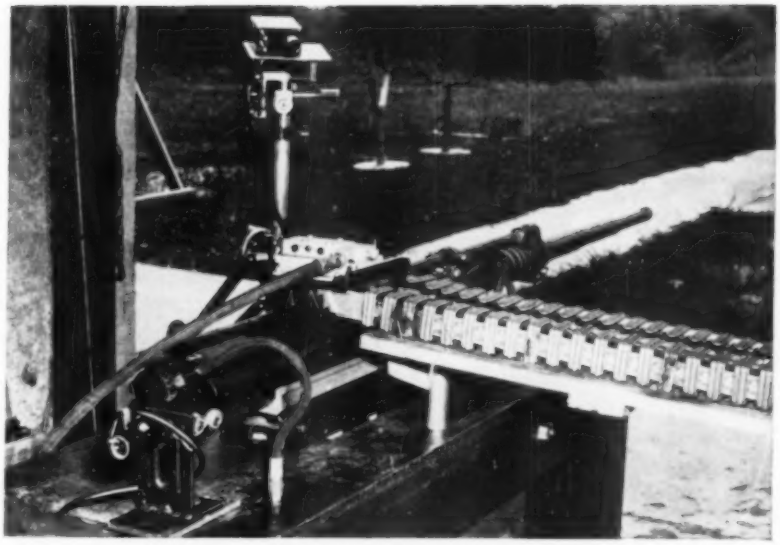

TV Views Test

Hazard-free close-up view of new Navy gun undergoing firing tests is made possible by closed-circuit TV system recently demonstrated by General Precision Laboratory at Naval Air Station, Chincoteague, Va. One TV camera (shown above) viewed gun from the front, while another viewed it from the rear of the chamber.

ucts, Inc., 32nd and Walnut Streets, Philadelphia, maker of communications and telemetry equipment. Company says nothing is changed but the name.

• **National Aeronautical Corp.** (Narco), Ambler, Pa., and **Canadian Marconi Co.**, Montreal, have signed agreement whereby Narco will handle U. S. distribution of Marconi's 301 automatic direction finder, while Marconi will serve as distributor for Narco line in Canada.

• **Sorensen & Co.**, Stamford, Conn., maker of low-voltage power supplies and line voltage regulators has merged with **Beta Electric Corp.**, New York, maker of high-voltage power supplies, electronic instruments and meters. Both retain corporate names and present managements.

• **Pacific Resistor Co.**, Los Angeles, is newly formed manufacturer of vitreous enameled power resistors, including miniaturized axial lead types for printed circuit applications. Herbert A. Guiness is president of new firm. Company's address: 1881 Sepulveda Blvd.

FILTER CENTER

▶ **Electronic Patents Increase**—Approximately 3,100 patents covering electronics were issued in the first six months of 1956, nearly equaling the number of electronic patents granted in all of 1955, according to an analysis made by Information For Industry, Inc. Roughly 10% of the patents were issued to Government agencies, including the Defense Department. Radio Corporation of America received 262 of the 3,130 electronic patents granted in 1955. Other major recipients of electronic patents included:

- **Bell Telephone Laboratories:** 170
- **General Electric:** 118
- **Westinghouse:** 85
- **International Telephone & Telegraph:** 51
- **Bendix Aviation:** 50

▶ **Data Link Contract**—General Electric reports receipt of a $12 million Air Force contract to produce airborne data link receivers. Equipment is manufactured by GE's Light Military Electronic Equipment Dept., Utica, N. Y.

▶ **Arctic SSB Tests**—First airborne tests on single sideband communications in the Arctic were conducted recently by Strategic Air Command and Collins Radio with an important assist from amateur radio operators around the globe. A SAC C-97, outfitted with a Collins commercial SSB ham equipment, made a 10,000 mi. test flight ranging from Pt. Barrow, Alaska, to Thule, Greenland. Using a 1 kw. transmitter and operating on the 15, 20 and 40 meter bands, the flying ham station worked a number of amateur stations, including one who identified himself as a ham in Moscow. The flying ham station picked up a signal from Little America in the Antarctic and retransmitted it back 11,000 mi. Col-

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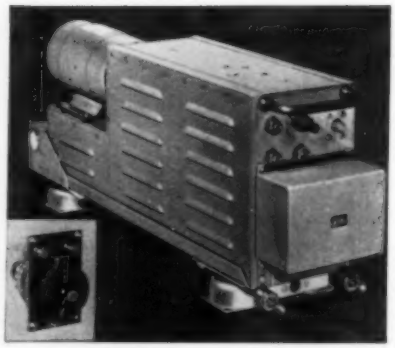

VHF Transceiver

New VHF transceiver, Model DTR-360, which provides 180 or 360 channels with 100 or 50 kc. channel spacing, respectively, is now available from Dayton Aviation Radio and Equipment Corp. (DARE). Transceiver, which can be operated either simplex or cross-channel (duplex), puts out 15 watts, comes in a ½ ATR size case and weighs only 22 lb., including power supply. Unit employs 38 crystals for 180-channel operation, 58 crystals for 360 channel use. Price of the 180-channel set for simplex operation is approximately $2,500. Manufacturer's address: Troy, Ohio.

lins reports that SSB proved very effective at times when auroral disturbances made conventional AM and CW difficult to understand.

► **Chidlaw To Speak**—"Electronics in Air Defense and Air Offense" will be the subject of a talk by General Benjamin Chidlaw at the Fifth Annual Industrial Electronics Symposium, Sept. 24-25, Hotel Manager, Cleveland. Chidlaw, former Commanding General of the Continental Air Defense Command, is vice president of Thompson Products. The Symosium is sponsored by AIEE and IRE.

► **Computer Symposium**—Third annual Computer Applications Symposium, Oct. 9-10, will be devoted to problems and experiences with medium-sized electronic computers. Symposium, sponsored by the Armour Research Foundation of the Illinois Institute of Technology, will be held at the Morrison Hotel, Chicago.

► **New RTCA Member**—Hastings-Raydist, Inc., Hampton, Va., formerly known as Hastings Instrument Co., has been elected to membership in the Radio Technical Commission for Aeronautics.

► **Computer Night Course**—Graduate program for full-time industry employes in the design, selection and operation of computers will be inaugurated this fall at the Stevens Institute of Tech-

nology, Hoboken, N. J. Classes will be held two nights a week for three years. Graduates will be awarded Master of Science degrees. Program, fully described in the Stevens catalog for 1956, begins Sept. 24.

▶ **Maryland Goes Avionic**—Maryland's Governor Theodore R. McKeldin has proclaimed week of Oct. 29 as Airborne Electronics Week in the state, following similar action by the mayor of Baltimore, scene of the Third Annual East Coast Conference on Aeronautical and Navigational Electronics, Oct. 29-30.

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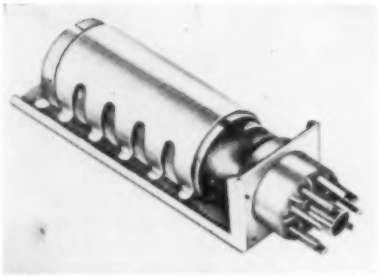
• **Potentiometer** for direct mounting in printed circuits, Type PC-5, measures ½ in. dia. x ¼ in. high. Resistance range is 10 to 35,000 ohms, terminal linearity

is 3%, dissipation is 2 watts and rotation is 325 degrees. George-Held, Inc., 1020 North LaBrea, Los Angeles 38, Calif.

• **High voltage silicon diodes,** available with peak inverse voltage ratings of 600, 800 and 1,000 v., with half wave d.c. output currents of 125 ma. at 75C, can operate over temperature range of −55 to 150C. Diodes measure ¾ in. dia. x ⅞ in. long and come with pigtail leads. Bulletin SR-138 gives application data. International Rectifier Corp., El Segundo, Calif.

• **Pulse packages** for radar transmitters, provide trigger or high power pulses, include charging choke, pulse-forming network and pulse transformer in a single sealed package. Filtron Co., Inc., Flushing, L. I., N. Y. or Culver City, Calif.

• **Subminiature tube mount and shield** for round-button bases tubes, permits ready access for maintenance. Right-



angle construction gives greater flexibility in mounting. Manufacturer also announces new heat dissipating shield for miniature power tubes of the type 826, 829B and 3E29 dimensions, which reportedly cuts bulb temperature by as much as 100 to 150C. International Electronic Research Corp., 145 West Magnolia Blvd., Burbank, Calif.

• **Sealed potentiometer,** Model DP-12, reportedly meets MIL requirements (Type RA-30). Unit is rated at 4 watts at 40C, derating to zero at 125C, comes in resistances of 100 to 40,000 ohms, with 5% tolerance or better if required. Shaft rotation is 275 degrees, linearity 3% and resolution is 0.5% maximum. Unit weighs 1.2 oz. Dale Products, Inc., Columbus, Nebraska.

• **Transistorized servo amplifier,** Model 1800-0300, will operate a size 15,400 cycle, 6.1 watt motor. Voltage gain is 750 at 3½ watts, 200 at 6 watts output. Unit weighs 6 oz., measures

approximately 1¼ x 1¾ x 3¾ in., can operate over temperature range of −55C to 71C. Input power required is 300 ma. at 28 v.d.c. M. Ten Bosch, Inc., Pleasantville, N. Y.

• **Printer circuit connectors** for 50, 70, and 93-ohm microminiature co-axial assemblies, are available for printed circuit boards ⅛ to ⅜ in. thick. Technical bulletin No. 44 gives details. Microdot, Inc., 1826 Fremont Ave., South Pasadena, Calif.

• **Induction potentiometer,** Size 11, with linearity of 0.1% over range of 0 to 75 degrees, has input impedance

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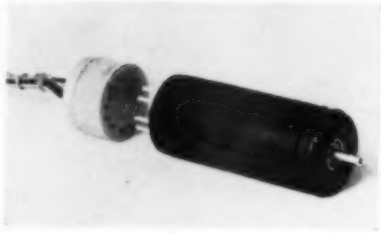


up to 750 ohms, phase shift of five minutes, and maximum null voltage of 1 mv. per volt of input. Unit weighs 4.7 oz. and can operate up to 70,000 ft. altitude without pressurization. Diehl Manufacturing Co., Finderne Plant, Somerville, N. J.

Test Equipment

• **Digital ratiometer,** Model R105, measures ratio of two d.c. voltages and displays results to five digits. Operating range is 00.000 to 99.999, accuracy is 0.01% of reading, resolution is one part in 100,000 and average reading time is 1,000 megohms. Unit operates from 115 v., 60 cycle power. Electro Instruments, Inc., 3794 Rosecrans St., San Diego, Calif.

• **High frequency transistor tester,** called Transalyzer, measures alpha and alpha cutoff of point contact, injunction and tetrode transistors. Device employs external oscilloscope to display alpha characteristics. Tester includes sweeping oscillator which operates over frequency range of 50 kc. to 50 mc., attenuators, d.c. biasing and metering circuits for the transistor and an rf amplifier and detector. Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

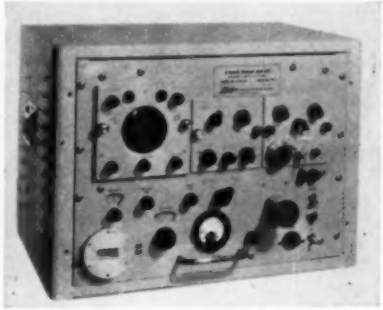
• **Resistance bridge,** Model 605, for speedy checking of resistances to an accuracy of 0.15% plus 0.05% full scale. Seven ranges from 100 ohms to 100 megohms (full scale) are available.

Lowest measurable resistance is 5 ohms. Tester is priced at $170 FOB factory. Shasta Division, Beckman Instruments, Inc., P. O. Box 296, Station A, Richmond, Calif.

• **Transistor curve tracer,** Model BCT 300, will display family of characteristic curves for all types of transistors on a standard laboratory oscilloscope. Measurements can be made in either forward or inverse direction, with grounded base or emitter.

Descriptive bulletin is available. Norden-Ketay Corp., 99 Park Ave., New York, N. Y.

• **Radar test set,** for complete check-out of radar and other microwave transmitters on a production line or in the field, is available for three frequency bands: 5.2 to 5.9 kmc., 8.5 to 10 kmc., and 15 to 17 kmc. Set includes spectrum analyzer, power monitor, frequency meter, signal generators with variable pulse, saw tooth and square wave modulation.



Test set operates from 103-125 v., single phase, 50 to 1,200 cycles,

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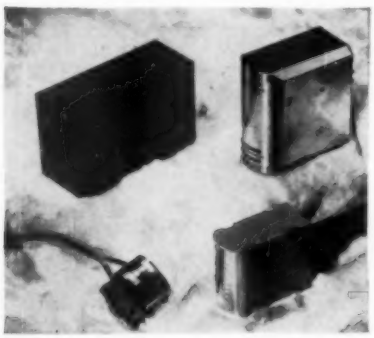
Kearfott Co., Inc., Western Div., 253 No. Vinedo Ave., Pasadena, Calif.

Instrumentation

• **Magnetic tape eraser,** Model 5,000 provides instantaneous eliminating of material recorded on tape on reels up to 16 in. in diameter. Unit weighs 33 lb., requires 2 kw. of 115 v., 50-60 cycle power. Smaller unit, Model 2,400 handles reels up to 9 in. dia., consumes 1 kw., weighs 16 lb.

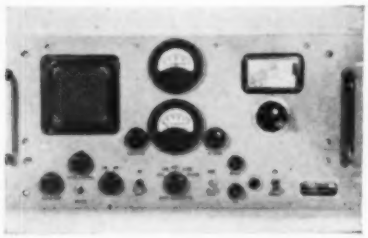
Kinevox Division of Electromation Co., 116 So. Hollywood Way, Burbank, Calif.

• **Multiple-channel** recording-playback heads for magnetic tape, reportedly are interchangeable without adjustment. New line includes heads for computer,



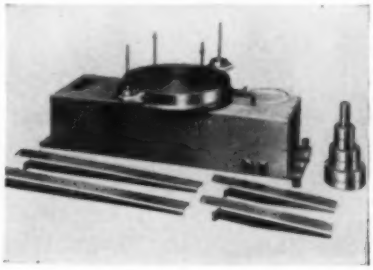
telemetering, and audio applications. J. B. Rea Co., Data Storage Devices Div., 1723 Cloverfield Road, Santa Monica, Calif.

• **Telemetry receiver,** Model 1502, for both FM and AM operation over the



frequency range of 55 to 260 mc. Receiver uses a 416-B planar triode in the first RF stage to assure low noise figure (under 6 db.) at any frequency. Receiver includes variable bandwidth control, squelch and IF gain control. Price is $1,750 FOB factory. Nems-Clarke, Inc., 919 Jesup-Blair Drive, Silver Spring, Md.

• **Angular accelerometer calibrator,** Model AA C-2, for calibrating transducers over the range of 0.5 to 140 radians per second squared. Device is a torsional pendulum device whose



period and amplitude of oscillation is adjustable.

Statham Development Corp., 12411 W. Olympic Blvd., Los Angeles 24, Calif.

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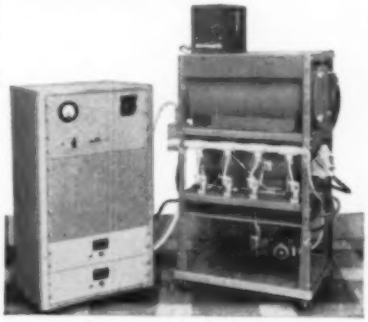

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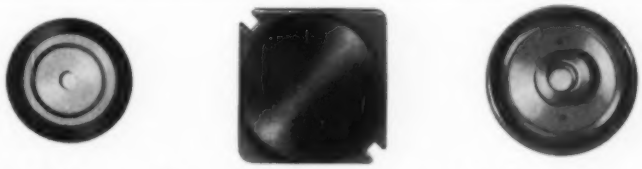

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Dr. S. H. Browne (left), Assistant Director of Research, J. H. Carter, Associate Director of Research and Staff Scientists P. L. Taulbee and E. V. Stearns discuss weapon requirements for defense of continental United States.

SYSTEMS PLANNING

▲ ▲ ▲

the basic approach to missile development

The concept of systems planning has many degrees of interpretation and application. At Lockheed Missile Systems Division it is a primary field of endeavor that is emphasized as the optimum method of missile development.

As applied at Lockheed, it begins with operational requirements and covers every phase of the development of a complete system through preliminary design. Coordinated creative effort is required among scientists and engineers in virtually all fields.

A number of highly significant new activities will appeal to those possessing keen interest in systems planning. Inquiries are invited.

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Industry Works Together on VTOL-STOL

Washington—Recent progress in the development of short and vertical take-off airplanes is largely due to the abandonment of traditional attitudes toward proprietary rights by a segment of the aircraft industry.

This revolution—and major strides toward successful VTOL and STOL designs—was inspired by the Office of Naval Research, which has used the approach that five heads are better than one.

Study Groups

The system is simple: It accomplishes research and development in critical fields by setting up study groups.

In effect, this means the Air Branch of ONR hires industry specialists as consultants.

In the case of VTOL, five companies are included—Fairchild Aircraft Corp., Vertol Aircraft Corp., Ryan Aeronautical Co., Hiller Helicopters and Bell Aircraft Corp. This does not mean, however, that proposals from other manufacturers are not included for consideration or that contracts cannot be given outside a chosen circle of manufacturers.

It does mean that ONR can select a small group of contractors with proven competence and have them work together and share their ideas.

Industry Benefits

"Once we overcome their apprehension over proprietary rights," an ONR official told AVIATION WEEK, "we can make the contractor sit around a table and conduct a detached discussion of what they know and what must be done."

The official said that each of the contractors finally finds that he is contributing one-fifth of the new knowledge and getting at least four-fifths in return.

The result is that a great number of engineering inhibitions are smashed, duplication of effort is avoided, ideas are more freely traded and—most important—progress is speeded.

The study group method used by ONR is the Navy's answer to the problem of shortening the development cycle, and there are indications that it will be proven within the next five to 15 years.

That is the period fixed by ONR for the replacement of many important present-day types of aircraft with radically new concepts, including VTOL and STOL aircraft.

All five of the companies in the study group have contracts, and most of them are busy on flying test-bed versions of such aircraft. Outside the group, there are independent projects under way and a few sponsored by the military services.

ONR Method

Doak Aircraft Co., a small California designer, has a contract for a ducted fan experiment and Piasecki Aircraft Corp., last week announced it will design and test a new concept. Piasecki's contract was given by the Navy Bureau of Aeronautics, although Army funds

Bell XV-3 Undergoes Phase I Tests

Wingtip housings for rotor systems are removed as Bell XV-3 Convertiplane undergoes Phase I flight tests at the Bell Aircraft Corp. plant, Ft. Worth, Tex. Conversions to 15 deg. forward mast angle in flight have been made successfully. Low power requirements in forward flight up to 80 kts. are indicated by evaluation flights in helicopter configuration. Autorotation checks from 500 ft. reveal good power-off characteristics, company reports. Vibration level is low because of flexible rotor mountings. Four-place craft was developed by Bell and the Air Research and Development Command, for Army. Single Pratt & Whitney engine is powerplant.

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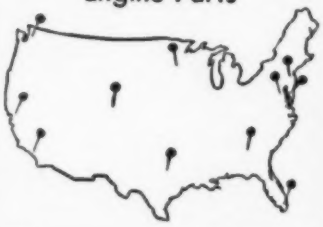

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- 5821 Seminary Road, Baileys Crossroads, Alexandria, Va.

Pratt & Whitney Aircraft

Division of United Aircraft Corporation
East Hartford, Connecticut

as well as money from ONR itself are included in the program.

It is basic to the ONR method that a more liberal interpretation be placed on the "need-to-know" restrictions that have hampered U. S. technological advances in the past. Like the Air Force in its disclosure of previously-secret Systems Requirements to qualified manufacturers, ONR now puts a study group to work only after a full explanation of the state of the art.

"Systems Analysis"

In the Navy, this is called a "systems analysis," which defines the military task to be performed, how an aircraft will be integrated into the system and what major characteristics are needed in the aircraft for the performance of its job.

An ONR spokesman admits that such a system has its weaknesses. For example, a systems analysis made in 1940 with a target date of 1950 would have ignored such subsequent developments as the atomic bomb, missiles, ram-jets, turbo-jets and swept-wing designs.

Why a Collective Approach

This illustrates one of the reasons why the collective approach, with talent enlisted from a number of manufacturers and bolstered by ONR's basic research work in universities and other laboratories, promises to speed development.

Another factor, one on which government officials refuse to be quoted, is the natural conservatism of the military commands that use aircraft. In general, the aircraft industry is given credit for being more progressive than its customers. But the procedure in the past has hampered design and development of equipment far in advance of published military requirements.

Major problem for the research experts has been the job of convincing

German Purchase List

Bonn—First aircraft orders under a program to equip West Germany's air force are expected to be placed this summer. Most of the planes in the defensive fleet will be procured from other countries, although Germany will build some trainer and transport types under license.

The West Germans will get 525 fighter planes free as a starter. The United States is providing 450 F-84F's. Last week 49 U.S.-made planes were turned over to the German air force. They included 29 AT-6s, and 20 Piper trainers, all having a total value of 3.3 million. Canada will give 75 F-86 Mk. 6 aircraft for day fighter use.

The purchasing program, still subject to change inasmuch as not all orders have yet been placed, calls for the following procurement:

Units	Type	Germans will pay: in 000 dollars	Supplying Country:
226	No. American F-86K Sabre	80,000	Italy
137	Nord Noratlas Transport	70,000	France
	" " "	120,000	Germany (und e license)
68	Hawker Seahawk	10,000	UK
16	Fairey Gannet	5,000	UK
11	Saunders-Roe helicopter	950	UK
83	Bristol 171 helicopter	16,000	UK
33	Hunting Percival Pembroke	3,000	UK
383	Fouga-Magister	74,000	Germany
265	Piaggio 149 trainer	5,000	Italy
	" " "	9,300	Germany
26	Sikorsky S-58	560	US
26	Piasecki H-21	6,800	US
14	Bell 47-G	600	US
14	Hiller 12-C	670	US
6	Sud-Ouest Djinn	230	France
428	Dornier DO 27	19,300	Germany
5	Grumman Albatross	2,800	US
96	Flight simulators	13,700	Various

The American-donated F-84F's will be de-mothballed and assembled in Bremen by Weserflug AG. Maintenance and repair of piston and jet engines of the air force fleet will be handled at Bonn by Daimler-Benz and BMW, and some engines also may be built in Germany under license agreements.

When the German Air Force is in being, it will be assigned to areas now divided between the 2nd and 4th Allied Tactical Air Forces. Recently-appointed chief of the Air Force is Lt. Gen. Josef Kammhuber.

Helio Buys Plant

Helio Aircraft Corp., manufacturers of the only certificated STOL-type aircraft, purchased the plant of Mid-States Manufacturing Co., in Pittsburg, Kan., for production of the Helio Courier, as predicted in Aviation Week several months ago.

The Courier, designed almost ten years ago by Prof. Otto C. Koppen of the Massachusetts Institute of Technology, can fly in and out of a space smaller than a football field at 30 mph. It cruises at 165 mph. The aircraft, already in production at the Mid-States plant under contract, is available for private and business fliers. Helio has no military contracts.

Lynn L. Bollinger, president of Helio, said the plant, as well as the company's original factory in Norwood, Mass., will do subcontracting for other manufacturers. At Norwood, Helio makes electronic components and conducts product development work.

administrators that an experimental model should be built. There have been instances where good ideas, originated and harbored by single manufacturers, have been kept behind a curtain of silence.

The result has been that the armed forces were using airplanes far inferior in performance than necessary.

ONR's open-door policy for contractors got its first test on a program to improve aircraft instrumentation started in 1953. About 20 airframe companies are taking part in this effort, which is co-ordinated by Douglas Aircraft Co. Another 300 organizations are involved, and all of them receive reports on new findings as soon as they are discovered.

Instrument Programs

Goal of the aircraft instrumentation program is the design of a new instrument panel that will make it possible for students to check out on instrument flight after an hour of familiarization. The Navy's new T2V trainer will be used to evaluate the panel.

A second program designed to integrate helicopter instrumentation has begun.

Bell Aircraft Corp. figures prominently in this work, and the entire helicopter industry probably will take part in the program before it is completed.

ONR's stimulation of work on STOL, in which the Army plays a prominent role, is expected to get top-level evaluation in the near future from the Defense Department. A committee set up by Dr. Clifford C. Furnas, assistant secretary of defense for research and development, has been surveying the entire field and will finish its report this month. The document will be circulated to the armed forces for comment before it is finalized. It is expected to single out the most promising design possibilities both in this country and abroad. Dr. James E. Lipp, of Lockheed Aircraft Corp., is chairman.

A second major study is that of a committee now working in the Pentagon on the problem of how to shorten the cycle from concept to inventory. The group has examined the ONR procedure closely and has prepared an evaluation of various military approaches.

This report is on the desk of Under Secretary of Defense Rueben B. Robertson.

Ryan Will Evaluate VTOL Cockpit Layout

San Diego, Calif.—Ryan Aeronautical Co. has been awarded an Air Force contract covering an exhaustive study of human factors in cockpit arrangement and instrument display for VTOL type aircraft.

Covered in the contract studies will be:

- **Control arrangement.**
- **Pilot seating.**
- **Required instruments** for the vertical flight component.
- **Automatic controls** requirements.

Ryan will evaluate the many possible configurations in a simulator which consists of a suspended cockpit free to move through more than 90 deg. in what would be an aircraft's pitch and yaw axes.

The vertical mounted cockpit is connected to an electronic computer which can receive signals initiated by control movements in the cockpit and translate them into cockpit motion. Unit also feeds data to the cockpit instrument panel to provide a realistic display during a simulated flight.

Simultaneously, the unit feeds information into a data recording system from which performance can be evaluated.

Russian Helicopter Gains FAI Approval of Records

The *Federation Aeronautique Internationale* (FAI) has homologated three world records claimed for the Russian Mi-4 Hound helicopter (AW June 25, p. 34).

Two are for altitude—19,472 ft. with a payload of two metric tons and 19,842 ft. with one metric ton—and one speed record of 116.3 mph. over a 310.7 mi. triangular course.

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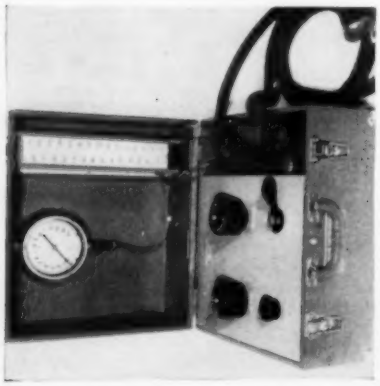


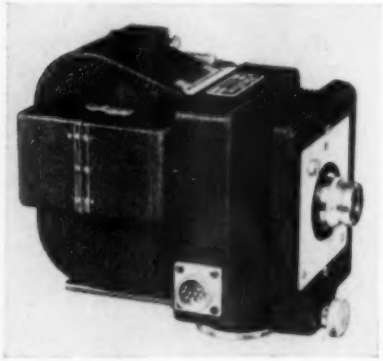
Pressure Test

Pilot pressure suits are quickly given preflight check with portable console designed to operate with oxygen pressure in the range of 100-150 psi. Suit pressure is indicated on gage, while mask pressure is shown on mercury manometer.

Manually operated, quick-acting, dump valve is provided which instantly releases mask pressure in event of accidental loss of suit (capstan) pressure. Special model of console incorporates automatic dump valve for release of mask pressure.

Available for use with console is a portable pressure source consisting of high pressure oxygen bottle, regulator, hose, and quick connector.

Zep Aero, 109 Sheldon St., El Segundo, Calif.



Recording Camera

Positive interlock prevents double exposure and new control for even exposure of supplementary data are incorporated in an improved version of Beattie Varitron Model E camera for laband industrial data recording. Film magazines accept both daylight and darkroom loading spools of 35 mm and 70 mm film. Earlier model Varitron film magazines may be used. Instantaneous and time exposure shutters are available and are interchangeable. Older model shutters may not be used.

Photographic Products Inc., 1000 N. Olive St., Anaheim, Calif.

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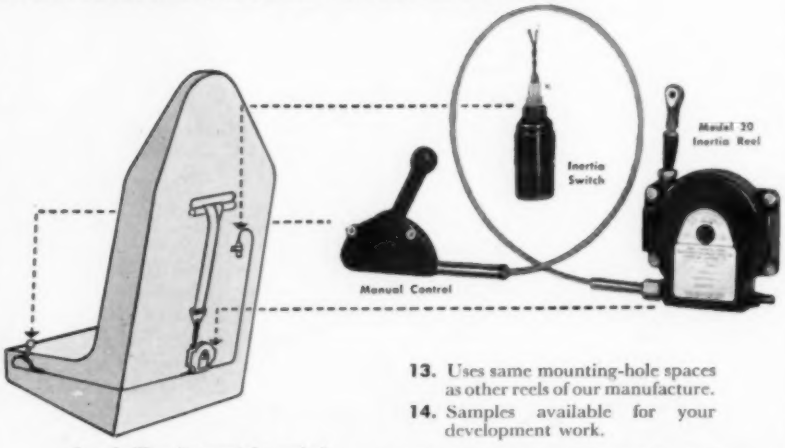
12. Design incorporates suggestions of aircraft manufacturers. Aircraft engineers available for consultation.
13. Uses same mounting-hole spaces as other reels of our manufacture.
14. Samples available for your development work.



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in jet bleed air ducts. In the event of a locking bolt failure a barbed tang maintains the seal. The bar is drawn into position as the bolt is tightened and may be released by thumb pressure after the bolt is unlatched. The safety feature adds .004 lb. to the weight of the coupling. There are 13 sizes ranging in weight from .40 lb. for a two inch assembly to .96 lb. for the six inch size. The couplings are designed for continuous use at 250 psi. and 750°F.

Aircraft-Automotive Division, Surface Combustion Corp., 400 Dublin Ave., Columbus 16, Ohio.

Solenoid Pilot Valve

Three-way solenoid operated pilot valve is qualified according to MIL-V-5529A, weighs seven ounces and is designed for a maximum leakage of five cubic centimeters per minute. They are suitable for service up to 3,000 psi at ambient temperatures ranging from −65 F. to 275 F.

Standard units are available with porting per AND10056-4 with the option of manual override.

The solenoid is a continuous duty type with an operating range of 18-30 volts DC and a maximum drain of 1.0 amps at −65 F.

Fisher Controls Inc., 1222 Seventh St., Santa Monica, Calif.

Fuel Boost Pump

Model RR-11650 fuel booster pump for high-octane gasoline or JP-4 is a totally submerged unit for transferring fuel between tanks or boosting the liquid to the engine system of heavy planes.

It is designed to separate vapor bubbles from fuel, has a main centrifugal type impeller and a vapor separating impeller on the motor shaft.

Performance is 42,000 pph. at 15 psi. minimum.

The 2.75-hp. motor, 200 v.a.c., 400 cps., three-phase 5,400 rpm., is cooled by direct inside and outside contact with fuel.

Lear-Romec Division, Lear, Inc., Elyria, Ohio.

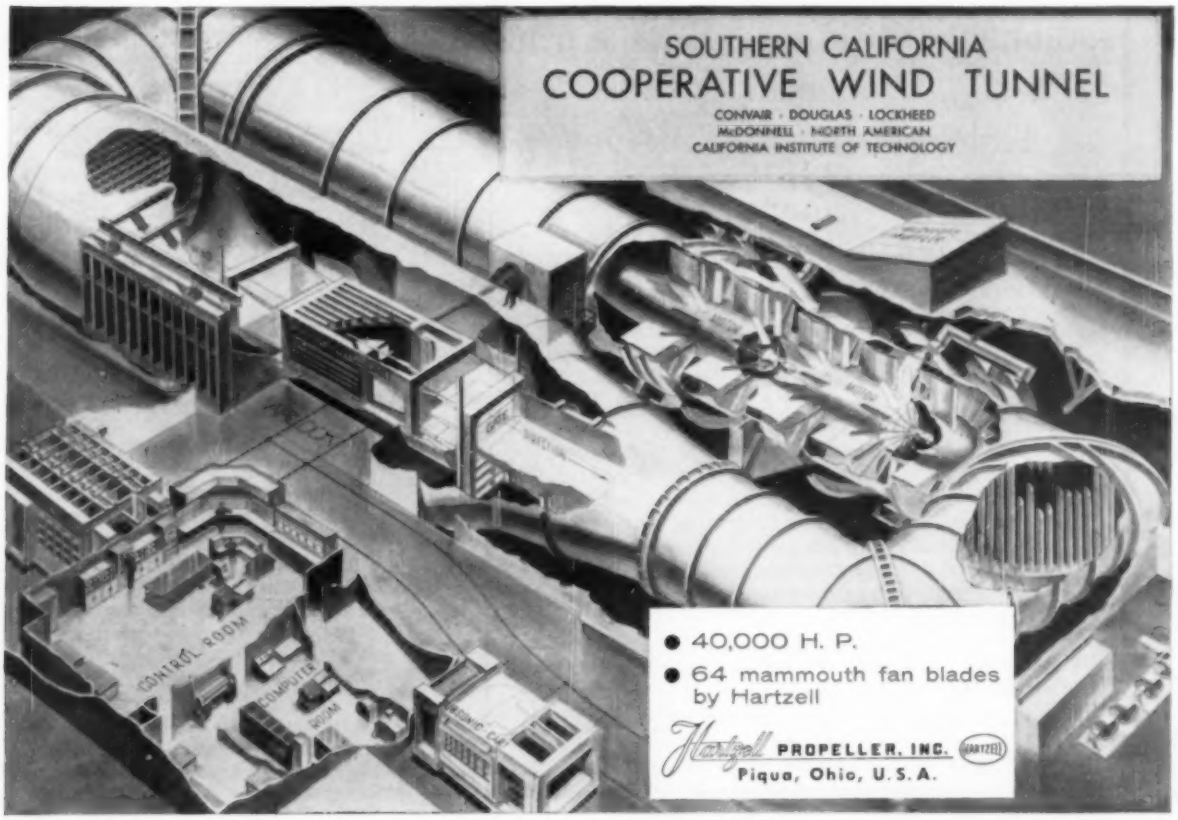
Thermocouple Reference Junction

Miniature multichannel "hot" thermocouple reference junction, reported to be rugged enough for missile use, operates from a.c. or d.c. and is stable to 1.5F. Any type of junctions can be specified, including iron-contantan, cromel-alumel, copper constantan.

Arnoux Corp., Dept. AW-7, Box 34628, Los Angeles, Calif.

Vibration Tester for Chamber

Model C25HB oil-cooled electrodynamic vibration exciter, designed especially for use in environmental test



chamber. Unit can be continuously operated at full-rated sinusoidal force output of 3,500 or 5,000 lb. and equivalent acceleration range from five to 2,000 cps. at simulated altitudes from 0 to 125,000 ft., relative humidities from 0 to 95% and temperatures between —100F and +300F.

The exciter can be rotated 90 deg. and operated in any position.

MB Manufacturing Co., a Division of Textron, Inc., New Haven, Conn.

Control Valve

Small flow control valve series with differential area pistons are designed for working pressures up to 6,000 psi. Differential area piston eliminates need for loading regulator and will stroke fully in either direction in 0.75 seconds. Open-on-air-failure or close-on-air failure action plus interchangeable valve trim in C$_v$ .005 to 2.5 are also available. Offset globe or angle bodies are featured with body sections rotatable in 90% increments for piping convenience.

The Annin Company, 6570 E. Telegraph Rd., Los Angeles 22, Calif.

ALSO ON THE MARKET

Kelon-T electrical spaghetti sleeving insulation is unaffected by a wide range of ambient temperatures, pressure altitude and humidity; remains servicable at temperatures from —90C to 250C. It is available in a variety of standard colors in cut lengths or on spools of 200 ft. lengths or longer; sizes range from #26 to #8 and larger.—Shamban Engineering Co., 11617 West Jefferson Blvd., Culver City, Calif.

Headloupe #502 can be easily moved in or out of position and can be worn over personal glasses. Item is made in two powers: 1¾ diopters, 13 in. focal range; 2½ diopters, 9 in. focal range.—Safety Division, Bover Campbell Co., 6540 St. Antoine, Detroit 2, Mich.

Portable hydraulic circuit tester, model PT-50-B, weighs 19 lb. and is contained in a reinforced case (7x11x8¾-in.) with carrying handle. Pressure range of 300 to 2,000 PSI, maximum flow of 50 GPM and temperature gage reading from 60 to 220 F. Unit simultaneously measures temperature, pressure and flow from any component port in a hydraulic system.—Schroeder Brothers Corp., 3116 Penn Ave., Pittsburgh 1, Pa.

Saf-Ears, custom fitted noise repelling plastic ear plugs for industrial and military use, are designed to reduce noise to a safe level for personnel. Two types of materials are used: one for reduction of certain low frequencies and another for low and middle frequencies.—Hartford Ear & Acoustic Research Laboratories, 190 Trumbull St., Hartford, Conn.

Type QHGR-750 Model 1, governor-controlled continuous duty DC drive motor, has —.3% speed variation; it is designed for high shock and vibration applications.

A gear train reduces shaft speed from 7344 to 1836 RPM. Average efficiency of unit is 48% with a maximum current of 6.3 amperes.

Weight: 2½ lb.; diameter: 2⅜ in.; overall length with gear train and governor: 5⅛ in.—John Oster Manufacturing Co., Avionic Div., Racine, Wis.

Model 5 vibraswitch malfunction detector picks up trouble in rotating and reciprocating machines, responds to slight increases in roughness or vibration, and causes shutdown before failure occurs. Unit covers all types of rotating equipment at speeds up to 18,000 rpm. Switch contacts are SPDT, split-contact NO, or split-contact NC rated at 7A up to 440 V.A.C.—Beta Corp., Forest Avenue at Ridge Rd., Richmond 26, Va.

Automatic Radioassay Systems for counting and recording data on large numbers of radioactive samples. System also helps fuel power reactors for the aircraft industry, analyzing distribution of neutrons inside a reactor.—Berkeley Division of Beckman Instruments, Inc., 2200 Wright Ave., Richmond 3, Calif.

Constant speed drive test stand (SD100) can simulate actual flight conditions by duplicating variations in engine speed to test their effects on aircraft constant speed drives.

Machine is designed to maintain any set speed at a constant value within close tolerances over entire operating range of from 200 to 8,500 rpm.—Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y.

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SAFETY

Lockheed Fuel Dumping Tests Add to Safety Margin In 1049G

Burbank, Calif.—Lockheed Aircraft Corp. has run a series of tests on fuel dumping in abnormal configurations, though not required by CAA, to ascertain effects of fuel dumps in other than certificated configurations.

CAA certification of the X Model 1049G, which uses the same wing, cowl and flap as earlier models, calls for fuel dumping in the clean configuration, at speeds approximating 150 mph. IAS.

Lockheed's tests were run on a production model of the same type as an airliner which recently caught fire and crashed during fuel dumping operations off New York.

Fourteen Tests

Fourteen tests were run during one airplane flight. Although the usual Lockheed practice is to use fuel when investigating fuel dumping, in this case water dyed red and with detergent and foam suppressor additives to approximate the surface tension of fuel, was used.

On the airplane, chalk base compound was painted to record how much liquid or spray touched the structure and where.

Tests were run dumping from the inboard chute on the left wing, and from the outboard chute on the right wing. In some tests, No. 2 engine was windmilled in conditions approximating, so far as is known, those of the airliner at the time of the crash.

Airflow Patterns

Aerodynamics specialists investigated any possible difference in airflow patterns on left and right sides of the airplane due to propeller slipstream, and certified that the outboard-one-side-and-inboard-the-other conditions were valid, that airflow patterns remained substantially similar on each side.

Dumps were at combinations of configuration and airspeeds. Flap settings were at 60% (takeoff) and full up, gear was up and down, and on the outboard dump chute tests, the landing light (6 ft. forward, 1 ft. outboard) of the dump chute was extended.

On the inboard dump chuts—mechanically operated with a Geneva switch controlling the sequence of first, chute extension, and second, opening fuel dumping valves—tests were run with the flaps at 60% gear up and down, No. 2 engine windmilling at 2,350 rpm. (flat pitch), and at 1,500 rpm. (coarse pitch).

In another test, flaps down 60% and gear down configuration was tried with deliberate dumping during the retraction of the dump chute. In this case, spray records showed on the trailing edge, middle and leading edge of the flap underside with several small dots recorded in the flap well. However, none of the spray records was in a position or concentration which would endanger the aircraft or promote a general wing fire.

Flap Vortex

Tests on the fixed outboard chute, which is electrically switch operated to open the dump valves and is located between the junction of the inboard end of the aileron and outboard edge of the flap, showed that with the flaps at 60% a vortex is generated and creates a distortion of the fuel dump plume, recording a spray of fuel on the upper side of the extreme trailing edge of the flap, but which is small in area and concentration. Also, extreme aileron deflections were applied during a pump, without abnormal distortion of the plume beyond that of the flap down vortex.

At low airspeeds gear extended and flap down during dumping, local airstream velocity is below normal, resulting in small spray patterns on the underside of the flap trailing edge, about 18 in. wide and low in concentration.

Additional tests were run by the Lockheed powerplant wind tunnel. A 1/10th scale model was constructed of the inboard chute area, and fuel was used and ignited in various tests. The normal pattern of airspeed over 100 mph. blowing out continuous ignition fires held true.

Single ignition of fuel being dumped at speeds over 100 mph. resulted in flame propagation failing and the fire blowing out. The scale section tests also were run with gear and flaps at various settings.

Produce Spots

In all, tests showed that a combination of windmilling engine, flap at 60% (takeoff) setting and gear extension were needed to produce any spots at all on the airplane while dumping with the chute in the normal extended position.

The inboard chute dumps the main

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MOTOROLA

(No. 1 and 2) tanks. The flap-down configuration produced vortex generated spots while outboard chute dumping was in progress, but with no appreciable effect from extreme aileron deflections as would be encountered in steep turns. The outboard chute dumps No. 3 and 4 wing tanks.

Continuous and single ignition of fuel dump plumes showed that a reasonable airspeed would cause flame propagation failure and blow the fire out. Continuous ignition would not support a fire even in the completely dirty configuration at airspeeds a safe margin above the stall point, Lockheed concluded from the tests.

ALPA Proposes Rules To Prevent Collisions

Chicago—Air Line Pilots Association's air traffic control committee at a three-day meeting here drew up 26 recommendations on traffic control for submission to the organization's board of directors.

The ALPA traffic control committee met jointly with the organization's investigating committee concerned with the collision of a TWA Constellation and a United Airline DC-6 over the Grand Canyon on June 30.

The meeting was called because of the association's "conviction that the Grand Canyon accident was permitted to occur because of obsolete air traffic control systems and regulations based upon it."

Among the recommendations ALPA said were "immediately implementable" are those which would:

- **Prevent any air** carrier pilot from operating IFR in uncontrolled airspace.
- **Eliminate 1000-ft.** on-top clearances, substituting 100% IFR above 9,500 ft. east of the 100th meridian, and above 14,500 ft. west of that meridian.
- **Raise VFR minimums** in controlled airspace to 1,500 ft. and 5 miles, and set the minimums elsewhere at 1,500 ft. and 3 miles.
- **Require control zones** at all airports with instrument approaches.
- **Allow controllers** to eliminate VFR traffic where IFR approaches are being conducted.
- **Eliminate VFR climb** and descent as part of an IFR clearance.
- **Implement speed control** at all high density traffic areas.

Long-range recommendations of the ALPA committee covered traffic information and communication, installation of configuration.

A lighting, improved cockpit visibility, development of an anti-collision device, upgrading controllers in high-density areas, and development of accurate altimeters.

Baker Wants Air Tax Spent for Control

Use of revenues from the 10% airline transportation tax for improvement of air traffic control has been proposed by G. T. Baker, National Airlines president, in a letter to Sen. George Smathers (D-Fla.).

Baker recommended that Civil Aeronautics Administration and Civil Aeronautics Board be given jurisdiction for administration and expenditure of the funds.

The domestic air transportation tax, he wrote, was imposed during World War II to discourage unnecessary personal travel and now should be used for the benefit of the traveling public which pays it.

Certificates of Necessity

The Office of Defense Mobilization has awarded General Electric Co., of Evendale, Ohio, a certificate of necessity for accelerated tax amortization in the amount of $19,176,414. The certificate is for a supersonic test facility, and 80% of the amount is eligible for rapid depreciation. Another certificate was awarded General Electric for an electronic devices facility in Pinellas County, Fla.

The certified amount for this facility is $4,984,500 and 75% is allowed at the rapid rate.

Other certificates for the period June 28 through July 11 are:

Westinghouse Electric Corp., Baltimore, Md., military electronic equipment, $4,675,000 certified with 45% allowed.

Pioneer-Central Div., Bendix Aviation Corp., Davenport, Iowa, research and development, $172,800 certified with 40% allowed.

Fairchild Engine Div., Fairchild Engine and Airplane Corp., Deer Park, N. Y., military aircraft engines, $370,907 certified with 65% allowed.

Siegler Corp., Anaheim, Calif., military electronic equipment, $375,000 certified with 40% allowed.

United States Testing Co., Hoboken, N. J., military electronic equipment, $18,355 certified with 65% allowed.

Gladden Products Corp., Glendale, Calif., military aircraft parts, $32,889 certified with 70% allowed.

Universal-Cyclops Steel Corp., Titusville, Pa., military aircraft engine parts, $642,700 certified with 65% allowed; military aircraft engine parts, $917,950 certified with 65% allowed.

Boeing Airplane Co., Seattle, Wash., military aircraft, $2,273,805 certified with 65% allowed.

George L. Nankervis Co., Detroit, Mich., military aircraft engines test facilities, $953,471 certified with 50% allowed.

Robertshaw-Fulton Controls Co., Anaheim, Calif., research and development, $170,000 certified with 50% allowed.

Standard Pressed Steel Co., Jenkintown, Pa., titanium fasteners for military aircraft, $2,635,300 certified with 65% allowed.

Kearfott Co., Inc., Little Falls, N. J., scientific instruments, $111,241 certified with 65% allowed.

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WHO'S WHERE

(Continued from page 23)

tional Civilian Service award by Brig. Gen. J. S. Holtoner. Mr. Fonda risked his life to rescue an Air Force pilot from the wreckage of a crashed airplane near Edwards AFB on Dec. 22, 1954.

Changes

Henry T. Harrison, director-meteorology, and **T. M. Plunkett,** weather control manager, United Air Lines.

Andrew McClements, helicopter development manager, Bristol Aircraft Ltd., England.

Andrew W. Hughes, comptroller, Rheem Manufacturing Co., New York, N. Y.

Thomas Fitzgibbon, chief design engineer, and **John Dannan,** assistant chief engineer, Hydro-Aire, Inc., Burbank, Calif.

Frank Nelson, manager-industrial supply operations, Garrett Corp., Los Angeles, Calif.

Dale S. Richins, chief metallurgist, Mercast Manufacturing Corp., La Verne, Calif.

Peter R. Eaton, manager of public relations, North America, Lufthansa German Airlines.

Joseph L. Dooling, director-contracts division, Hoffman Laboratories, Inc., Los Angeles, Calif.

William M. Duke, program director-Titan ICBM program, Ramo-Wooldridge Corp., Los Angeles, Calif.

Miguel Pombo, U. S. regional manager, Avianca (Colombian National Airways).

Leigh Clayton, European area engineer (Stockholm, Sweden), Logistics Research, Inc., Redondo Beach, Calif.

Robert C. Smith, treasurer, Chase Brass & Copper Co., Waterbury, Conn.

Robert E. Waltz, station manager (St. Croix, Virgin Islands), Pan American World Airways. Also: **Richard J. Abbott,** traffic representative, PAA Latin American Division (Idlewild airport, N. Y.).

Air Vice Marshal John L. Plant (RCAF, ret.) has joined Collins Radio Company of Canada Ltd., Ottawa.

Murray Berkow, assistant sales manager-weapons systems, and **Lou Helmuth,** assistant sales manager-administration, Republic Aviation Corp., Farmingdale, N. Y.

F. S. Gais, chief reliability engineer, Missile Engineering Division, McDonnell Aircraft Corp., St. Louis, Mo.

John K. Cochran, manager-production, Fiber Glass Division, Pittsburgh, Plate Glass Co., Pittsburgh, Pa.

James J. Ward, assistant division manager, and **Charles A. Kerner,** chief engineer, Anaheim Division, Northrop Aircraft, Inc., Hawthorne, Calif.

Col. George E. Bostwick, Air Force plant representative, Convair, San Diego, Calif. He replaces **Col. J. F. McCarthy, Jr.,** who has been assigned to the Air War College.

J. E. Harling, operations manager-manufacturing and purchasing, Air Logistics Corp., Pasadena, Calif.

John E. Clute, Jr., manager, Thiem Industries, Inc., Gardena, Calif. Also: **Byron I. Foreman,** chief production engineer, and **William Lanquillon,** superintendent.

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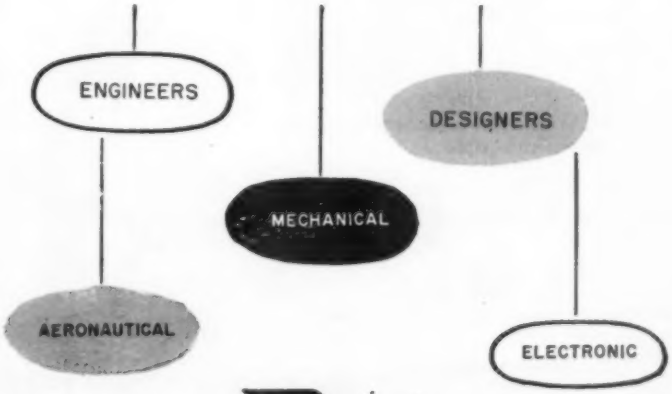

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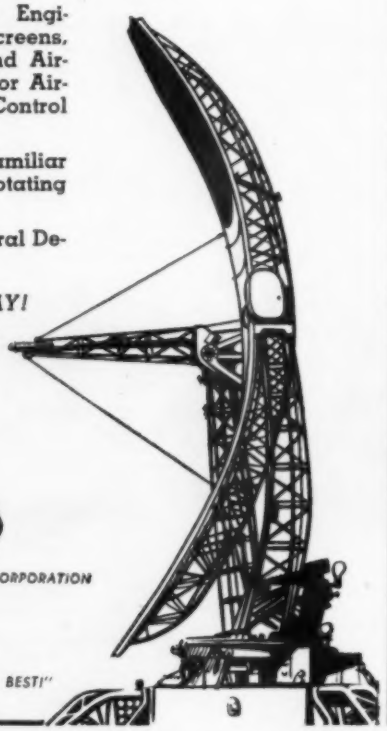

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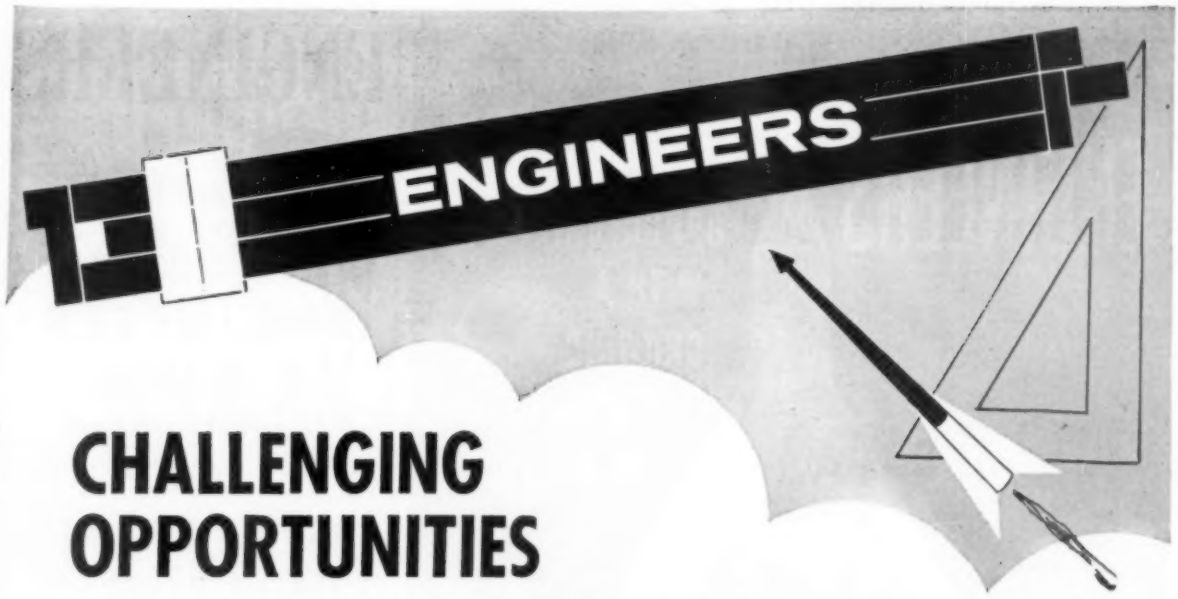

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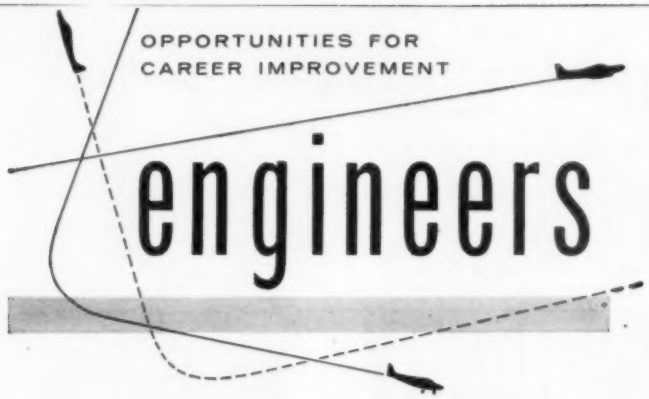

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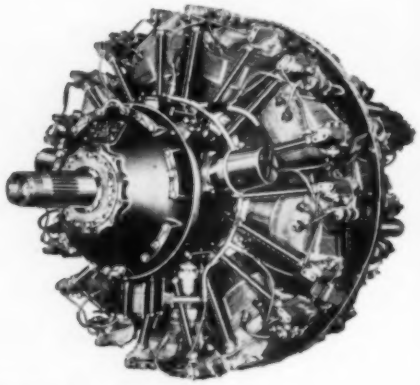

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LETTERS

Javelin Praise

Having had the pleasure of knowing some of the great English test pilots such as Neville Duke, Bill Bedford, Kiwi Hawkins, and Danny Norman, Sqd. Ldr. W. A. Waterton's article concerning the Javelin was quite a revelation as it is generally understood, among people who know, that Waterton was responsible for setting back the Javelin program a fair ol' bit.

As a reminder, they (the British) now hold the world altitude record, the world speed record, and the world's best aircraft control procedures. (The last is my opinion, the first two are published.) So I guess when Capital Airlines starts using the Comet and the English-Electric P1 sets the new world speed record, that will set them under completely.

CHARLIE BROWN
Arlington, Va.

Company View

It's been highly interesting to read the many-sided opinions on the current engineer situation. It seems to the writer that much good can come from exposing the many sides of this serious problem—which is a thorn for engineers as well as for those-who-wish-to-hire engineers.

I don't believe one of these problems—a serious one at Puritan—has been particularly stressed, but already it has affected several engineering candidates adversely.

Briefly, we have so far turned down several prospects for development (creative) engineering posts here. The men looked good, there was no salary problem, living conditions seemed to be o.k., but the catch was that we knew when we talked to these men that they were not considering Puritan as a future but only as a stepping stone to another job which required experience of the type we could provide.

We knew that our investment in these men would be considerable, and felt that their jumping on to what they felt was greener pastures just about the time they started to make money for our company—or rather to start paying back what we had spent already—was hardly worth the expense.

So they were turned down. It was too bad, too, for they showed promise.

Now the conclusion may emerge from the foregoing that perhaps we have no good employe program and have a turn over every two years or so. If that were the case, the fault would primarily be with us.

However, the reverse is much closer to the truth and our turnover of personnel, particularly in the skilled and professional categories, is extremely low. Then, you might say, "Why the worry—why not hire the man and take your chance on selling him on the advantages of your company?"

This is a reasonable rebuttal except that when you see the applicants and see job after job listed of a year or two duration, each successive job paying a $1,000 or so more, one cannot help but wonder whether the applicant plans to work for a company or use that company as a stepping stone. It looks as though he fought constantly any permanent integration into a company team.

Our problem is further complicated by our conviction that a good engineer, particularly in development work, will need close to two years before he will really be carrying his own weight.

Thus, you see that although *his* personal achievement program may be nicely completed in an approximate two-year period, it is about the time when his *company* achievement program begins to pay off.

But at that point he leaves. Any wonder we're a little chary of hiring him?

This problem is particularly serious in a medium size or small size company where each man must carry his own weight and where engineering departments are not so vast as to lose personnel. It is a problem, too, that requires some clear, introspective thinking on the part of the engineering candidates.

We would be very interested in hearing what others have to say about this.

FRED C. STEBBINS
Aviation Sales Manager
Puritan Compressed Gas Corporation
Kansas City 8, Mo.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Computer for Job

In your recent paper on gas dynamics (AW June 25, 1956) you state:

"—one authority believes that even the very latest and largest such computers are not fully capable of handling the problem."

The Remington Rand Univac Division of Sperry Rand Corporation has under development a new electronic computer which will be especially suited to handling problems of the type you mentioned. The computer is the UNIVAC LARC and the first one will be delivered in 1958 to the University of California Radiation Laboratory at Livermore, Calif.

If you will furnish me the name and address of the "one authority," I will send him a copy of the specifications for the LARC.

THOMAS W. WILDER, III
Regional Electonics Representative
UNIVAC Division
Remington Rand
41 First Street
San Francisco 5, Calif.

Licked Gears Earlier

We read with interest of Sperry's .5 megabuck investment for the machinery to cut the most accurate production gears ever made to angular tolerances of 10 seconds. At Northrop, we were faced with virtually the same problem several years ago. Although we didn't manage to spend $500,000 for tooling, we have, and are, cutting 60 deg. worm gear sectors, on a production basis, which when meshed with their driving worms and properly bearinged, do not exceed a maximum angular error at any point of ±5 seconds of arc. A large percentage of these sectors display errors not exceeding ±3½ seconds. Some gears have displayed errors of less than ±2½ seconds. Rejections to date have run 4%.

The machine used was developed entirely at Northrop in support of our Snark guidance program and the first sectors were successfully cut in 1950. The machine itself weighs about 50 lb. Gears to specification have been cut in both aluminum and steel.

Although we recognize that a sector and a full gear are not directly comparable, it is our belief that a sector is the more difficult to cut. The technique used is such that errors are not accumulative or periodic and we therefore don't anticipate any particular difficulties in extending our technique to include full gears. Since our present needs do not include full gears, no particular effort has been made in this direction. However, a program to exploit this aspect of the technique has been underway for the past several months on a low priority basis.

As a matter of interest, inspection of worms and lead screws is accomplished with an interferometric device which was also developed entirely at Northrop. This machine is capable of checking and producing a continuous plot of lead errors on any helix up to 3" long, unattended, at a rate of 3"/hour to an accuracy of .00002 inches. This machine is also in continuous use in our production program.

Too bad Northrop wasn't included on that list of 100 vendors. This kind of stuff is "old hat" to us!

R. D. JAMES, SUPERVISOR
Mechanical Development
Northrop Aircraft, Inc.
Hawthorne, Calif.

Whooping Cough

In your July 16 issue you featured an article, "Brazilian Airlift Treats Whooping Cough." You state that this service might be the only one in the world. Such is not the case. In Austria and especially Vienna, a similar service for children suffering from whooping cough is performed by the "Austrian Alpine Flying Rescue Service." These flights are on the same nonprofit basis as in Brazil and have been available for more than 1½ years. The results of treatment, so far as is known to the writer, were satisfactory. An old Fokker and a deHavilland Rapid were used.

This letter is written only to inform you that other countries realized the importance of high altitude treatment of whooping cough.

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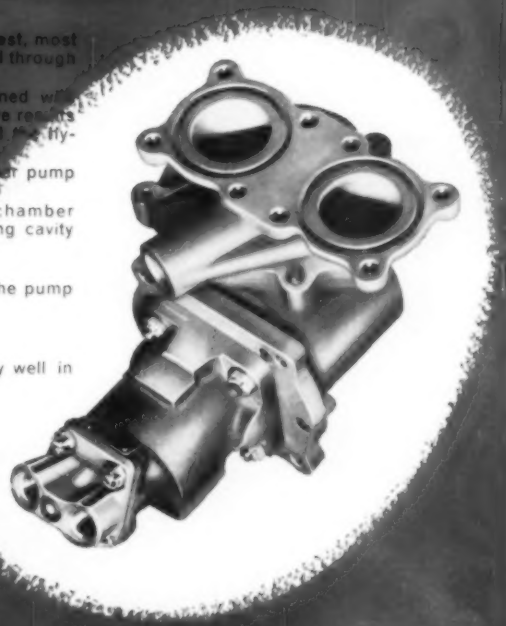

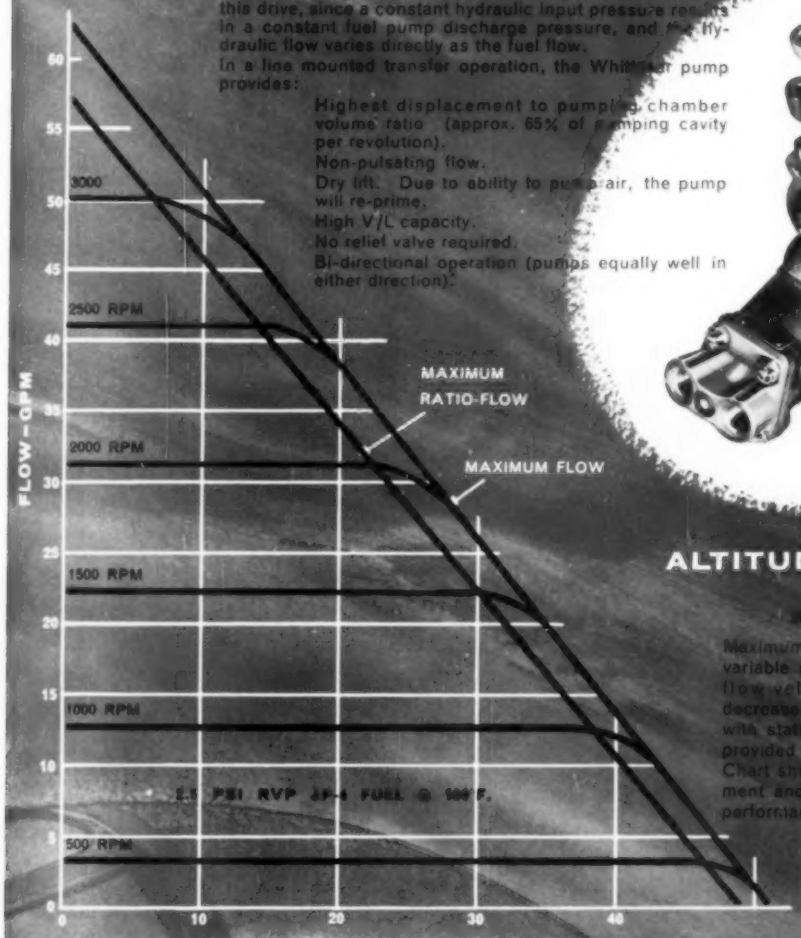

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